

JOURNAL OF CREATION

Vol. 30(1) 2016

ISSN 1036-2916

CREATION.com



Speciation

Design for a fallen world?

Global warming
and 'climate
change': guidelines
for discernment

The Red Sea
Crossing: can
science model
miracles?

Empirical
evidence
and seafloor
spreading

Naturalistic
origin of
the moon
eclipsed?



JOURNAL OF CREATION

An international journal devoted to the presentation and discussion of technical aspects of the sciences such as geology, biology, astronomy, etc., and also geography, archaeology, biblical history, philosophy, etc., as they relate to the study of biblical creation and Noah's Flood.

COVER: A liger; a hybrid between a male lion (*Panthera leo*) and a female tiger (*Panthera tigris*).

PHOTO: © tunart/istockphoto.com

Editorial correspondence should be addressed to:

The Editor

Journal of Creation
Creation Ministries International
 PO Box 4545
 Eight Mile Plains
 QLD 4113
 AUSTRALIA

Email: journal@creation.info

Editorial Team

Dr Pierre Jerlström (head)
 Dr Don Batten
 Shaun Doyle
 Dr Ron Neller
 Dr Jonathan Sarfati
 Dr Tas Walker

Production and Design

Tim Kneipp

Assistance and/or Sub-editing

Russell Grigg

SUBSCRIPTION INFORMATION

AUSTRALIA

Creation Ministries International
 P.O. Box 4545,
 Eight Mile Plains QLD 4113, Australia
 Phone: (07) 3340 9888
 Fax: (07) 3340 9889
 Subscription: A\$39 (3 issues)

CANADA

Creation Ministries International
 300 Mill St, Unit 7, Kitchener, ON
 N2M 5G8
 Phone: (519) 746 7616
 Fax: (519) 746 7617
 Subscriptions and orders only:
1-888-251-5360
 Subscription: C\$39 (3 issues)

NEW ZEALAND

Creation Ministries International
 P.O. Box 39005, Howick,
 Auckland 2145, New Zealand
 Phone and fax: (09) 537 4818
 Subscription: NZ\$59 (3 issues)

SINGAPORE

Creation Ministries International
 P.O. Box 195, 911207, Singapore
 Phone and fax: (65) 9698 4292
 Subscription: S\$50 (3 issues)

SOUTH AFRICA

Creation Ministries International
 P.O. Box 3349,
 Durbanville 7551, South Africa
 Phone: (021) 979 0107
 Fax: (086) 519 0555
 Subscription: R320 (3 issues)

UK and EUROPE

Creation Ministries International
 15 Station Street
 Whetstone
 Leicestershire, LE8 6JS
 United Kingdom
 Phone: (44) 0116 2848 999
 (To email use web 'contact us' form)
 Subscription: £25 (3 issues)

USA

Creation Ministries International
 P.O. Box 350,
 Powder Springs, GA 30127, USA.
 Phone: (800) 6161-CMI
 Fax: (770) 439 9784
 Subscription: US\$39 (3 issues)

OTHER COUNTRIES

Creation Ministries International
 P.O. Box 4545,
 Eight Mile Plains QLD 4113, Australia
 Phone: (+617) 3340 9888
 Fax: (+617) 3340 9889
 Subscription: A\$46 (3 issues):
 Please remit in Australian dollars or
 advise MasterCard or Visa card details

CREATION.com

Printed in Australia,

Published by:

Creation Ministries International Ltd

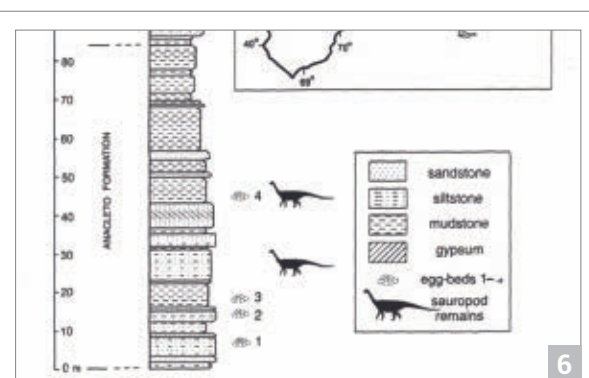
ABN 31 010 120 304



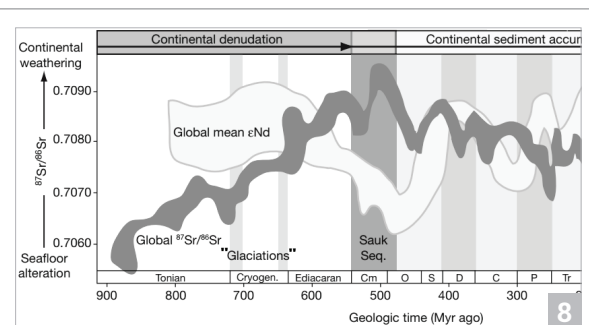
Creation Ministries International (CMI)—formerly *Answers in Genesis* in Australia, Canada, New Zealand, Singapore, South Africa and UK/Europe—is a non-profit evangelical group of ministries around the world which, though independent, form an operational unity. We share not only this *Journal of Creation* and the associated *Creation* family magazine, but the same biblical platform, and overall outreach and educational vision. In addition, we communicate and co-operate with bonafide creationist researchers from all over the world. The expanding effectiveness of these ministries, and the future of quality biblical creation research in general, depends on donations from concerned individuals. These may be made to the CMI office in your country. For other countries, our Australian office is able to receive personal cheques in your own currency, or simply write, phone or fax with your MasterCard or Visa details (including expiry date and amount). We are a fully audited ministry.

PERSPECTIVES

- 3** Global warming and 'climate change'—recent developments and guidelines for discernment
» Jake Hebert
- 6** Argentina egg site supports BEDS model
» Michael J. Oard
- 8** The 'Great Unconformity' and associated geochemical evidence for Noahic Flood erosion
» Harry Dickens
- 11** Little erosion beneath Antarctica and Greenland Ice Sheets
» Michael J. Oard
- 14** Naturalistic origin of the moon comes under hard times
» Michael J. Oard



How were dinosaur eggs and embryos fossilized in a 'floodplain environment' in Acahuasi, Argentina?



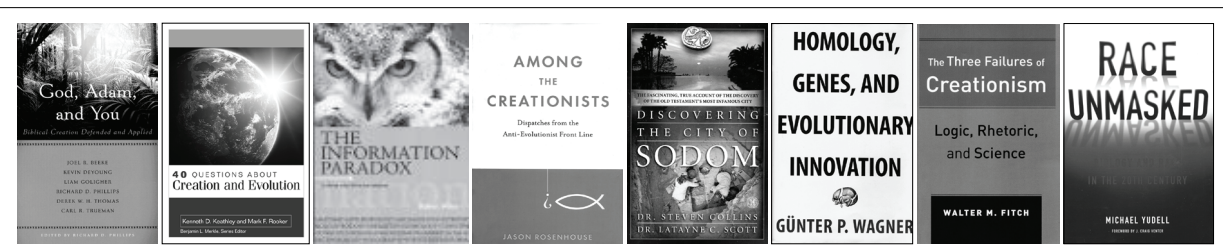
The 'Great Unconformity' stratigraphic surface is evidence for the Bible's Flood.

BOOK REVIEWS

- 16** Strong defence of the biblical Adam
» Lita Cosner
» *God, Adam, and You: Biblical Creation Defended and Applied* (Richard D. Phillips (Ed.))
- 19** Irreconcilable records of history and muddled methodology
» Nick Sabato
» *40 Questions About Creation and Evolution* (Kenneth D. Keathley and Mark F. Rooker)
- 25** Is this life, the universe, and everything?
» Alex Williams
» *The Information Paradox* (Robert Wiles)
- 28** An atheist rubs shoulders with creationists
» John Woodmorappe
» *Among the Creationists: Dispatches from the Anti-Evolutionist Front Line* (Jason Rosenhouse)
- 33** A northern Sodom?
» Murray R. Adamthwaite
» *Discovering the City of Sodom: The Fascinating, True Account of the Discovery of the Old Testament's Most Infamous City* (Steven Collins and Latayne C. Scott)
- 36** Developmental genetics supports creation theory
» Walter ReMine
» *Homology, Genes, and Evolutionary Innovation* (Günter P. Wagner)
- 43** A very shallow anti-creationist book that emphasizes logic but is devoid of it
» John Woodmorappe
» *The Three Failures of Creationism: Logic, Rhetoric, and Science* (Walter M. Fitch)
- 47** Science saturated with racism
» Jerry Bergman
» *Race Unmasked: Biology and Race in the 20th Century* (Michael Yudell)

VIEWPOINT

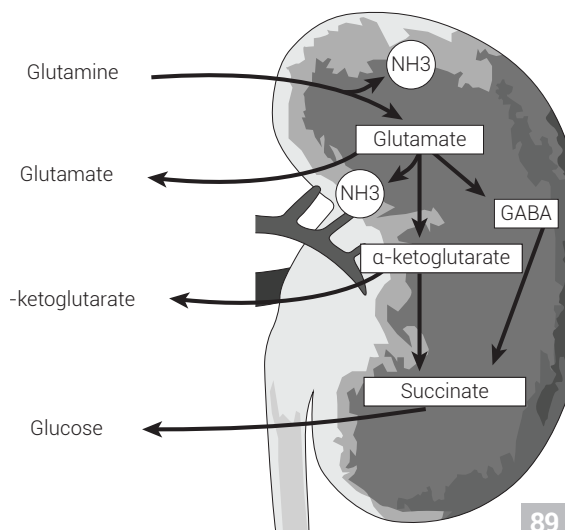
- 51** What does the Bible say about the fabric of space?
» Alan Pace
- 56** The geography of Genesis 8:4
» Bill Crouse



OVERVIEWS

- 63** The Cenozoic, Flood processes, and post-Flood catastrophism—problems and parameters?
» Michael J. Oard
- 70** Towards a creationary view of why speciation occurs
» Jean K. Lightner
- 76** Empirical data support seafloor spreading and catastrophic plate tectonics
» Timothy L. Clarey

Gluconeogenesis in the kidney



To help survive adverse conditions organisms have been designed to recycle everything that normal metabolism manufactures.

89

PAPERS

- 83** Changing paradigms in stratigraphy—"a quite different way of analyzing the record"
» John K. Reed
- 89** Reversible autopoiesis—a foundational design principle for life's survival
» Alex Williams
- 97** Evidence strongly suggests the Laurentide Ice Sheet was thin
» Michael J. Oard
- 105** Pseudogenes and bacterial genome decay
» Jean O'Micks
- 112** Languages of the post-Diluvian World
» Murray R. Adamthwaite



112

Does the Tower of Babel event explain the original complexity and array of unrelated languages in antiquity?

ESSAYS

- 122** The Red Sea Crossing: can secular science model miracles?
» John K. Reed and Carl R. Froede Jr

ABOUT US



What is Creation Ministries International Ltd?

Creation Ministries International Ltd. is an independent, non-profit, non-denominational organization, controlled by Christians in the fields of science and education, committed to researching, developing, and promoting Christian creationist materials, and Christian school texts and aids. Our work is based on acceptance of:

- » The Bible is the written Word of God. It is divinely inspired and inerrant throughout.
- » The final guide to the interpretation of Scripture is Scripture itself.
- » The account of origins presented in Genesis is a simple but factual presentation of actual

events and therefore provides a reliable framework for scientific research into the question of the origin and history of life, mankind, the earth and the universe.

- » Scripture teaches a recent origin for man and the whole creation.
- » The great Flood of Genesis was an actual historic event, worldwide (global) in its extent and effect.
- » The special creation of Adam (as one man) and Eve (as one woman) and their subsequent fall into sin, is the basis for the necessity of salvation for mankind (and thus for the Gospel of Jesus Christ).
- » The scientific aspects of creation are important, but are secondary in importance to the proclamation of the Gospel of Jesus Christ as Sovereign, Creator, Redeemer and Judge.

Please note that in all of this, we openly proclaim

that our work is centred around Jesus Christ. We are convinced that the real needs of men and women can only be met by reconciliation to God through faith in and commitment to Jesus Christ the Creator, as Lord and Saviour.

© *Creation Ministries International Ltd.* All rights reserved. No part of this journal may be reproduced in any manner without written permission.

AN EXCEPTION is made where for study or for review purposes permission is granted for limited amounts of this publication to be copied provided due acknowledgment is given.

The views expressed in *Journal of Creation* are those of the writer(s) and not necessarily those of the Editors of *Journal of Creation* or the Directors of *Creation Ministries International*.

For instructions to authors, see the last page.

Global warming and 'climate change'—recent developments and guidelines for discernment

Jake Hebert

An increasing number of evangelical Christian leaders have publicly stated that combatting 'global warming' or 'climate change' is a moral imperative.¹ Likewise, Pope Francis recently called for action on this issue in a recent encyclical letter.² However, at the same time, some scientists and environmental activists have become quite skeptical of alarmism on this issue, including former president of Greenpeace Canada Patrick Moore, physicist Freeman Dyson, and emeritus MIT professor of meteorology Richard Lindzen.^{3–5}

Creation perspectives

Creation Ministries International, this journal's publisher, does not have an 'official' position on this issue, stating that this is a 'wisdom issue' on which Christians can reasonably disagree.⁶ Likewise, creation scientists have generally been quite cautious on this issue. Physicist Russell Humphreys has argued that recent warming has occurred, but that it is not a reason for panic and that higher atmospheric carbon dioxide levels likely contributed to abundant vegetation in the pre-Flood world.⁷ Likewise, creation scientist (and former meteorologist for the National Weather Service) Michael Oard has stated that a small amount of warming has occurred, but that most of the warming is probably due to natural climate variations.⁸ And atmospheric

scientist (and former researcher at the Institute for Creation Research) Larry Vardiman did his own independent analysis of three different data sets and concluded that global warming had probably been occurring for the last 30–50 years.⁹

Of course, the fact that warming has occurred does not necessarily mean that it will continue, nor does it necessarily imply that human activity is responsible, as Vardiman was quick to point out.

The controversy—recent developments

Much of the concern over 'global warming' or 'climate change' results from computer models that predict continued increases in global surface temperatures as a result of increasing atmospheric carbon dioxide. However, one obvious problem with such predictions is that these computer models have failed to predict an apparent lengthy 'pause' or 'hiatus' (figure 1) in this warming trend: from 1998–2012, for instance, the warming trend was only one third to one half that of the warming trend for 1951–2012.¹⁰ Some have argued that the pause was due to warming of the Pacific and Indian Oceans.¹¹ A paper published in *Science* in the summer of 2015, authored primarily by NOAA (National Oceanic and Atmospheric Administration, United States) scientists, however, argues that 'improvements' in the earth's surface observational temperature record show that this apparent pause is not real.¹²

This claim has already been challenged,¹³ and many were quite suspicious of this revision to the temperature data that retroactively 'erased' the pause. Congressman Lamar Smith, head of the House of Representatives Committee on Science, Space, and Technology, has requested that NOAA hand over internal communications that are relevant to the temperature revision,

but NOAA has refused, arguing that to do so would undermine the scientific process.¹⁴

Likewise, Georgia Institute of Technology climatologist Judith Curry wrote an editorial that broached the possibility of possible coordination between NOAA scientists and politicians eager to take aggressive action to fight climate change.¹⁵ The fact that a prominent climate scientist would be willing to seriously entertain such a possibility in a public forum is quite telling. NOAA issued a press release stating the 'death' of the pause just as the United States Environmental Protection Agency (EPA) was preparing to issue a 'Clean Power Plan' designed to reduce carbon emissions by existing power plants.¹⁶ Likewise, the press release occurred a couple of months before the 2015 United Nations Climate Change Conference (COP 21) was scheduled to begin in Paris, France.¹⁷ Furthermore, Curry had already noted that if the pause were to continue for twenty years or more, a pause not predicted by *any* climate models, then this would raise serious questions about the adequacy of those climate models.¹⁸ Hence, this paper's publication was, in multiple ways, very fortuitous (perhaps suspiciously so) for the 'warmist' side of this debate.

Nor is this the first instance in which suspicions of data manipulation have been aired. The well-known 'hockey stick' graph¹⁹ of Penn State climatologist Michael Mann (a modified version of it appeared in the movie *An Inconvenient Truth*) has been roundly criticized by other researchers, most notably Canadian researchers Stephen McIntyre and Ross McKittrick.^{20–22} A summary of their criticisms is cringe-inducing: "collation errors, unjustifiable truncation or extrapolation of source data, obsolete data, geographical location errors, incorrect calculation of principal components and other quality control defects."²⁰ Worse yet, McIntyre and McKittrick have presented evidence that Mann

was aware that his analysis was problematic but that he failed to disclose this.²³ Their arguments have persuaded a number of high-profile scientists, including Nobel Prize-winning physicist Richard Muller, that the famous ‘hockey stick’ was deeply flawed.²⁴

So what is a conscientious Christian supposed to do? How does one discern the truth in this matter? Was the pause real, or not? Is warming within the last half of the 20th century truly unprecedented, and, if so, what, if anything, should be done about it? The study of climate is a complicated and specialized field, and it is difficult for scientists, especially if not directly involved in this subdiscipline, to understand all the details and nuances of these issues. Having a biblical worldview is essential for both laypeople *and* scientists when attempting to navigate such complex topics.

Principles for discernment

CMI has previously outlined some principles to bear in mind when pondering this issue, and here I put forth some other considerations:⁶

Indications of extreme bias

While all scientists have biases (included creation scientists), there is such a thing as *extreme* bias. Are there reasons to question the objectivity of those pushing for draconian action to fight ‘climate change’? James Hansen, former director of the Goddard Institute for Space Studies, has been *arrested* (!) at least four times in climate-related protests.²⁵ He has also stated that coal is the “single greatest threat to civilization and all life on our planet” and that “trains carrying coal to power plants are death trains”.²⁶ Such over-the-top rhetoric is an indication of extreme bias, of zealotry out of keeping with objective analysis.

Failed predictions

Have those claiming dire consequences of global warming made previous predictions that have not come to pass? Failure of past predictions is a good reason to view current ‘doomsday’ predictions with skepticism.²⁷

Underlying assumptions

Are there implicit unbiblical assumptions behind a particular conclusion? For instance, Vardiman has long noted a subtle connection between climate change alarmism and a denial of biblical history. Most secular scientists accept the Milankovitch (astronomical) hypothesis of Pleistocene ice ages, but they also realize that the changes in seasonal and latitudinal sunlight distribution resulting from variations in Earth’s orbital and rotational motions are too small to, themselves, be the sole cause of an ice age. Hence, they believe that a small ‘push’ from other factors, such as the amount of carbon dioxide in the atmosphere, amount of sea ice, etc., can amplify these small changes, resulting in catastrophic climate

change.²⁸ They fail to recognize that the Ice Age was caused by a large ‘push’ from a never-to-be-repeated event, the Genesis Flood. Likewise, because of their ‘deep time’ interpretation of ice core data, uniformitarians believe that oxygen isotope ratios in deep ice cores are indicative of rapid climate fluctuations during a supposed previous warm period called an interglacial. Because uniformitarians believe that ‘the present is the key to the past’, and because they believe that we are now in another interglacial, they think that these dramatic climate changes could also occur today.²⁹ However, they fail to recognize that the climate after the Flood was a unique, transitional, climate. Hence it is invalid to extrapolate such presumed past climate changes into the present.

Testing the ‘fruit’

The Lord Jesus told us that we could test the fruits of a person or teacher: “For a good tree does not bear bad fruit, nor does a bad tree bear good fruit. For every tree is known by its own fruit. For men do not gather

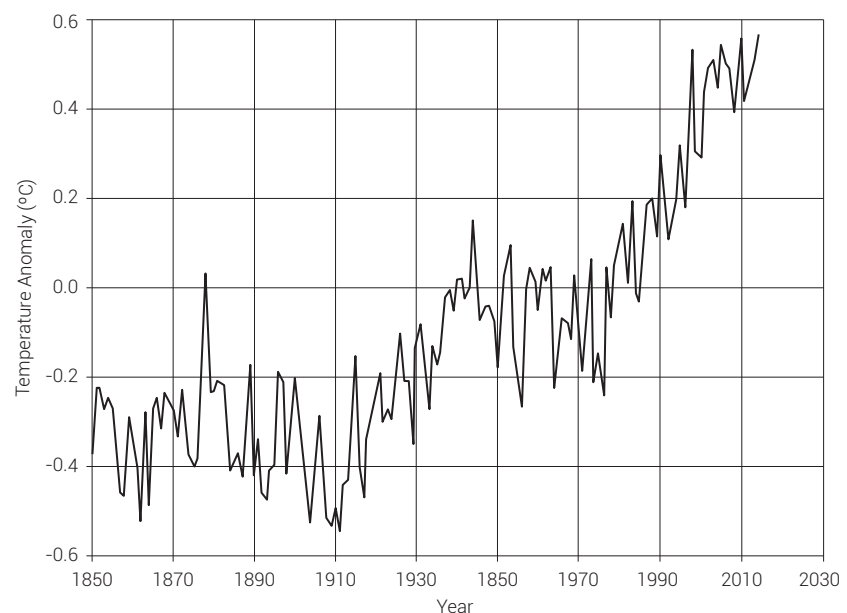


Figure 1. Yearly global surface temperature anomalies (in °C) from the 1961–1990 global average. Note the apparent ‘levelling off’ of the rate of warming from 1998 to 2013. Data source: Met Office Hadley Centre observations dataset.³³

figs from thorns, nor do they gather grapes from a bramble bush” (Luke 6:43–44, NKJV). This obviously can be applied to intellectual movements or ideologies, as well.³⁰ There are many indications that climate change alarmism is bearing bad fruit. An article in *Nature* actually suggested that tens of millions of acres of fallow farmland should remain uncultivated in order to fight climate change.³¹ Given the number of hungry people in the world, it is shocking that some would seriously contemplate such action. So secular academics are now entertaining restrictions, not just on automobile fuel efficiency, energy consumption, etc., but on the amount of food that we produce! Likewise, one secular ‘intellectual’ has proposed modifying the human body in order to fight climate change.³² These examples of bad fruit are indicative of something fundamentally wrong with the ‘warmist’ movement.

Obviously, we should be willing to modify our positions as new information comes to light. I personally have tried to keep an open mind on this issue, but factors such as those above cause me to be extremely skeptical of alarmism over this issue and to be concerned that some Christians (not to mention policy makers) are accepting claims that may not be scientifically justified.

References

- Climate Change: An Evangelical Call to Action, 2006, The Evangelical Climate Initiative, www.npr.org/documents/2006/feb/evangelical/calltoaction.pdf, accessed 19 November 2015.
- Faiola, A., Boorstein, M. and Mooney, C., Release of encyclical reveals pope’s deep dive into climate science, *The Washington Post*, 8 June 2015, www.washingtonpost.com/local/how-pope-francis-not-yet-official-document-on-climate-change-is-already-stirring-controversy/2015/06/17/ef4d46be-14fe-11e5-9518-f9e0a8959f32_story.html.
- Ridley, M., Global warming: evidence high CO₂ levels good for crops, oceans, *The Australian*, 19 October 2015, www.theaustralian.com.au/news/world/global-warming-evidence-high-co2-levels-good-for-crops-oceans/story-fnb64oie-1227574026685.
- Lemonick, M.D., Freeman Dyson Takes on the Climate Establishment, *Yale Environment* 360, 2009; e360.yale.edu/content/feature.msp?id=2151, accessed 4 June 2015.
- Morano, M., Prominent Scientists Declare Climate Claims Ahead of UN Summit ‘Irrational’—‘Based on Nonsense’—Leading us down a false path, www.climatedepot.com/2015/11/19/scientists-declare-un-climate-summit-goals-irrational-based-on-nonsense-leading-us-down-a-false-path/, 19 November 2015.
- Wieland, C., Global warming (or climate change): what is ‘the creationist view’? creation.com/global-warming-what-is-the-creationist-view, 3 January 2007.
- Humphreys, R., God’s global warming worked just fine: Evidence from the pre-Flood world suggests that we need not fear global warming from carbon dioxide, creation.com/global-warming-facts-and-myths, 8 November 2009. See also Idso, C.D., The Positive Externalities of Carbon Dioxide: Estimating the Monetary Benefits of Rising Atmospheric CO₂ Concentrations on Global Food Production, Center for the Study of Carbon Dioxide and Global Change, [web.uvic.ca/~kooten/Agriculture/CO2FoodBenefit\(2013\).pdf](http://web.uvic.ca/~kooten/Agriculture/CO2FoodBenefit(2013).pdf), accessed 14 December 2015.
- Oard, M.J., *The Great Global Warming Debate: The facts, the fiction and the furor* (DVD), Creation Ministries International, 2010.
- Vardiman, L., Evidence for global warming, *Acts & Facts* 36(4), 2007; www.icr.org/article/evidence-for-global-warming, accessed 19 November 2015.
- Flato, G., Marotzke, J., Abiodun, B. *et al.*, Evaluation of Climate Models; in: Stocker, T.F., Qin, D., Plattner, G.-K. M. *et al.* (Eds.), *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press, Cambridge, United Kingdom, p. 769, 2013; www.ipcc.ch/pdf/assessment-report/ar5/wg1/WG1AR5_Chapter09_FINAL.pdf, accessed 19 November 2015.
- Nieves, V., Willis, J.K. and Patzert, W.C., Recent hiatus caused by decadal shift in Indo-Pacific heating, *Science* 31 (6247):532–535, 2015.
- Karl, T.R., Arguez, A., Huang, B. *et al.*, Possible artifacts of data biases in the recent global surface warming hiatus, *Science* 348 (6242):1469–1472, 2015.
- Trenberth, K.E., Has there been a hiatus? *Science* 349 (6249): 691–692, 2015.
- Tollefson, J., US science agency refuses request for climate records, www.nature.com/news/us-science-agency-refuses-request-for-climate-records-1.18660, 28 October 2015.
- Curry, J., Is the government tinkering with global warming data? www.foxnews.com/opinion/2015/11/05/is-government-tinkering-with-global-warming-data.html, 05 November 2015.
- Clean Power Plan for Existing Power Plants, United States Environmental Protection Agency, www2.epa.gov/cleanpowerplan/clean-power-plan-existing-power-plants, accessed 19 November 2015.
- United Nations Conference on Climate Change, www.cop21.gouv.fr/en/, accessed 19 November 2015.
- Curry, J., Implications for climate models of their disagreement with observations, judithcurry.com/2013/10/30/implications-for-climate-models-of-their-disagreement-with-observations/, 30 October 2013.
- The graph showed a long period of relative stability of global temperature, with an extreme upward movement only in recent times, likened to a hockey stick lying on the ground with the stick’s blade poking up in the air.
- McIntyre, S. and McKittrick, R., Corrections to the Mann *et al.* (1998) proxy data base and northern hemispheric average temperature series, *Energy and Environment* 14(6):751–771, 2003; www.multi-science.co.uk/mcintyre-mckittrick.pdf, accessed 19 November 2015.
- McKittrick, R., What is the ‘Hockey Stick’ Debate About? Invited Special Conference Presentation ‘Managing Climate Change—Practicalities and Realities in a Post-Kyoto Future’ before the Parliament House, Canberra, Australia, www.uoguelph.ca/~rmckittrick/research/McKittrick-hockystick.pdf, 19 April 2005.
- McIntyre, S. and McKittrick, R., Hockey sticks, principal components, and spurious significance, *Geophysical Research Letters* 32, L03710; www.climateaudit.info/pdf/mcintyre.mckittrick.2005.grl.pdf, accessed 24 November 2015.
- McKittrick, ref. 21, pp. 11–12.
- Muller, R., Global Warming Bombshell, MIT Technology Review, www.technologyreview.com/news/403256/global-warming-bombshell/, 15 October 2004.
- Top NASA scientist arrested (again) in White House protest, www.foxnews.com/science/2013/02/13/top-nasa-climate-scientist-arrested-again-in-white-house-protest.html, 13 February 2013.
- Hansen, J., Coal-fired power stations are death factories, Close them, www.theguardian.com/commentisfree/2009/feb/15/james-hansen-power-plants-coal, 14 February 2009.
- Adams, D., UN scientists warn time is running out to tackle global warming, *The Guardian*, www.theguardian.com/environment/2007/may/05/climatechange.climatechangeenvironment, 4 May 2007.
- Vardiman, L., *Climates Before and After the Genesis Flood*, Institute for Creation Research, El Cajon, CA, pp. 54–55, 2001.
- Oard, M.J., *The Frozen Record*, Institute for Creation Research, El Cajon, CA, pp. 126–128, 2005.
- Gurney, R., Roots and fruits, *Creation* 34(3): 20–22, 2012.
- Schiermeier, Q., Quandary over Soviet croplands, *Nature* 504 (7480):342, 2013; www.nature.com/news/quandary-over-soviet-croplands-1.14388, 18 December 2013.
- Liao, S.M., Human Engineering and Climate Change, *Ethics, Policy, and the Environment* 15(2), 2012; www.fhi.ox.ac.uk/human-engineering-climate-change.pdf, accessed 24 November 2015.
- Morice, C.P., Kennedy, J.J., Rayner, N.A. and Jones, P.D., Quantifying uncertainties in global and regional temperature change using an ensemble of observational estimates: The HadCRUT4 dataset, *J. Geophysical Research* 117:D08101, 2012, doi: 10.1029/2011JD017187; www.metoffice.gov.uk/hadobs/hadcrut4/data/current/time_series/HadCRUT.4.4.0.0.annual_ns_avg.txt. Contains public sector information licensed under the Open Government License v3.0.

Argentina egg site supports BEDS model

Michael J. Oard

Auca Mahuevo in Neuquén Province in west-central Argentina is a well-known site for dinosaur eggs.¹ Uniformitarian scientists have published a significant body of information on the local sedimentology and stratigraphy. Their analysis of the remarkable embryonic remains, egg-shell microstructure, and ‘nests’²⁻⁴ concluded: “The discoveries our

crew made raised dozens of scientific mysteries.”⁵

The Auca Mahuevo site is slightly larger than 1 km². The 86 m of strata that are exposed are considered Upper Cretaceous fluvial deposits and consist of sandstone, siltstone, and mudstone with weak ‘paleosol’ development. The site contains thousands of eggs, some with fossilized embryos,⁶ embryonic bone and skin, and many dinosaur tracks. The eggs are found scattered, sometimes forming carpets of eggs, and some are found in clutches or ‘nests’. Some clutches are as close together as 1–3 m.

There are four levels of eggs within the finer-grained siltstone and mudstone layers within a 40 m vertical

interval (figure 1). The scientists claim to have identified six nest structures.⁷ The eggs were laid by a titanosaur, a large sauropod.⁸ A few of its remains are also found in the formation.

Rapid fossilization of egg contents

One of the mysteries for uniformitarian science includes explaining how the eggs and embryos were fossilized quickly enough to be preserved, especially if the site is part of a ‘floodplain environment’. In their own words:

“Also, exactly how did the eggs and embryos become fossilized? We are sure that floods buried the eggs and nests in mud, but what processes of mineralization operated quickly enough that the poorly formed embryonic bones and skin became fossilized before they could decay?”⁹

It is obvious that flooding had to have buried the eggs and embryos rapidly. Mineralization of the soft embryo tissues indicates that burial had to have been virtually instantaneous.¹⁰

The ‘nest structures’ are possibly dinosaur tracks

Scientists admit that structured nests, typified by a depression with a raised rim, are absent in the fine-grained sediments:

“With the exception of six nesting traces preserved in sandstone (channel and crevasse splay deposits) in egg bed 4, thousands of eggs at Auca Mahuevo occur in mudstone and show no discernible evidence of nest structure.”¹¹

The lack of nests in the finer-grained sedimentary rocks is blamed on movement from swelling clay.¹¹

Uniformitarian scientists concluded that many of the eggs must have been moved:

“Movement of either individual eggs or subsets of eggs along slickensided surfaces (1) modified the number

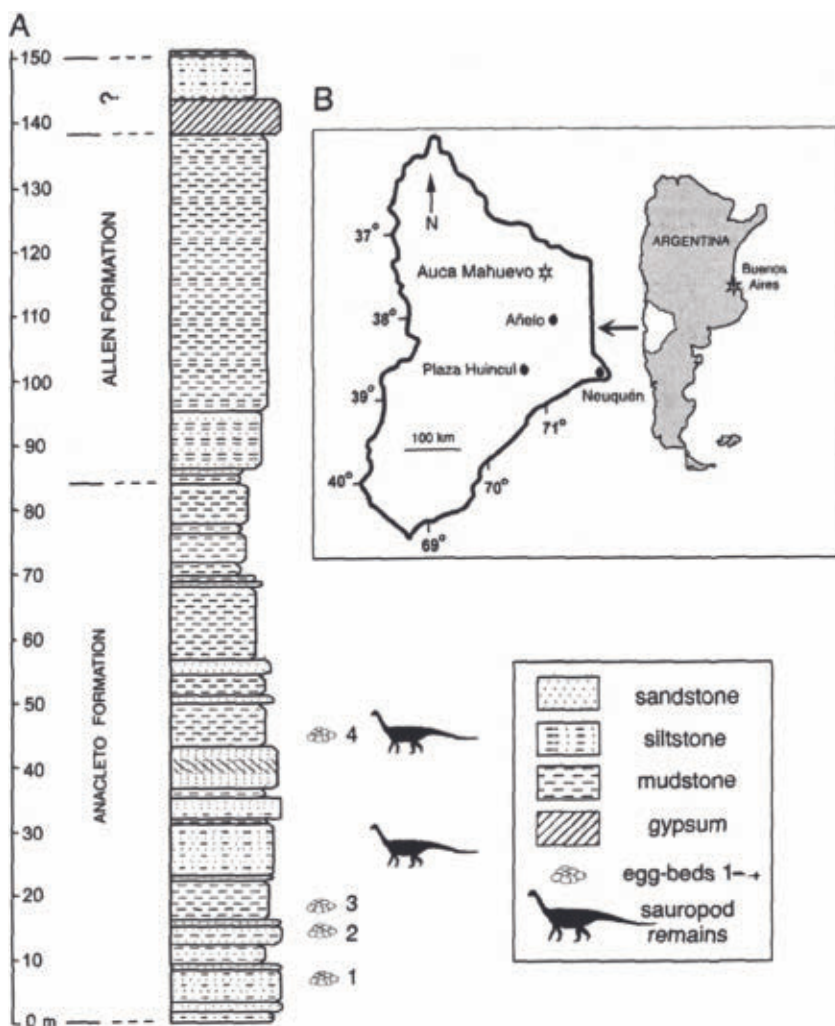


Figure 1. A composite stratigraphic section of the Auca Mahuevo locality (from Jackson *et al.*¹)

and relative position of eggs within individual clutches, (2) combined eggs of one or more clutches produced by different females, and (3) combined eggs from one or more nesting horizons, producing a time-averaged fossil assemblage.”¹²

At face value there seems to have been an excessive amount of movement, but the movement is attributed to the faulting and heaving of swelling clay during the claimed paleosol development. The Auca Mahuevo paleosols contain expansive clays and can be classified as vertisols, but clays are not necessarily proof of ancient soils. The movement of the strata produced ridges and troughs a little more than a metre long and up to half a metre high. The troughs contained a few eggs but they are not considered nests.¹¹ There were also eggs on the ridges, which would support the author’s interpretation of expanding of swelling clay.

Around the world millions of dinosaur eggs have been found on continents.¹³ It is very rare to find nest structures associated with dinosaur eggs. There are so few nests that they can almost be counted on one set of hands.^{7,14} This mystery of the many eggs but few nests is easily solved if the dinosaurs did not have time to make nests. Under normal circumstances, the porosity of the eggs (see below) would make nest building imperative.

The porous structure of the eggs requires the parent to cover them with vegetation or the embryo would dry out and die but, strangely, the eggs were found mainly in the open.¹⁵ It is possible that at one time they were overlaid with vegetation, but evidence for vegetation and pollen is rare.¹⁶ Scientists find essentially the same situation all over the earth.¹⁴ The data can be interpreted to indicate that the dinosaurs did not have time to dig a hole or find vegetation to cover their eggs before some kind of disaster arrived. All of the sites indicate the dinosaurs faced a very abnormal situation.

Interestingly, a new development suggests the six ‘nests’ in the sandstone are probably dinosaur tracks:

“One of the authors (GGT) examined the rimmed nests made in the Auco Mahuevo paleoriver silty sediments (Garrido, 2010b) and recognized them as dinosaur manus [hand] and pes [foot] prints with associated lateral sediment displacements...”¹⁷

Eliminating these six structures would shrink the number of nest structures found around the world by more than half.

The BEDS hypothesis can explain the data

The discoveries at the Argentine fossil egg site supports the Briefly Exposed Diluvial Sediments (BEDS) hypothesis proposed by Oard.¹⁴ ‘Episodic large flood events’ can produce BEDS in which the level of the floodwater oscillated up and down with different amplitudes and lengths of time of exposure. Global floodwaters would have oscillated up and down due to tides, tsunamis, nearby as well as distant tectonics, and other mechanisms. There would be different lengths of time that the sediments would be exposed. During a temporary drop in the level of the floodwater, dinosaurs from higher nearby ground or floating in the floodwater could climb onto the BEDS. The next rise would cover the eggs, tracks, and dead dinosaurs. Floodwater oscillations would regularly send a layer of sediment over previous BEDS. The stratigraphic section at Auca Mahuevo shows alternating thin sandstones, usually less than 1 m thick, with thicker layers of mud (figure 1). The lack of nest structures provides evidence that the eggs were laid in a hurry.

Movement of eggs could be due to the movement of swelling clay, brief transport in light currents, or sedimentation during egg laying.¹⁸ The

rapid deposition of sediment and oscillation of water levels during the Flood can explain the rapid fossilization after burial. Today, major floods are known to deposit no more than a few metres of sediment, whereas the fine-grained sediments found at the site are about 5–10 m thick and homogeneous. A floodplain environment today typically does not produce any of these effects. In a real floodplain, the paleontologists should find local changes in the type of sediment as well as cut and fill structures.

The fact that there are four levels of eggs with the remains of titanosaurs on two levels (figure 1) adds support to the oscillatory Flood model. The same type of dinosaur laid the eggs on all four BEDS. In the uniformitarian model, the sequence should be an accumulation of sediment over hundreds of thousands of years. How probable is it for the same type of dinosaur to frequent the same spot hundreds of thousands of years later?

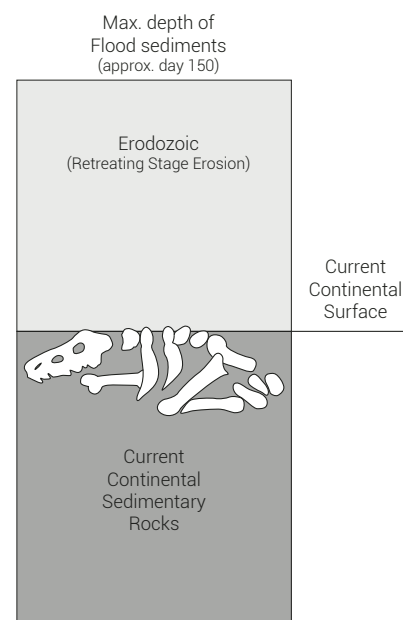


Figure 2. A block diagram showing the current continental surface and the volume of sedimentary rocks eroded after Day 150. Much sediment and sedimentary rock has been eroded to expose the level where dinosaur fossils and traces are found today. (Drawn by Melanie Richard).

In the Creation model the dinosaur eggs and tracks were most likely made between Day 40 and about Day 120 of the Flood. If they were laid during the first 40 days of heavy rain, the rain would have washed away the tracks and eggs. Conversely they had to have been laid before the peak of the Flood, which occurred on or near Day 150 (figure 2),¹⁹ when the Bible tells us that all air-breathing flesh had perished. Between Day 40 and 120 the level of the Flood water would have oscillated during an overall rise, the time of the biblical ‘prevailing’. The oscillations could explain the alternating sandstone/mudstone sedimentation.

References

1. Jackson, F.D., Schmitt, J.G. and Oser, S.E., Influence of Vertisol development on sauropod egg taphonomy and distribution at the Auca Mahuevo locality, Patagonia, Argentina, *Palaeogeography, Palaeoclimatology, Palaeoecology* **386**:300–307, 2013.
2. Chiappe, L., Dinosaur embryos: unscrambling the past in Patagonia, *National Geographic* **194**(6):35–41, 1998.
3. Chiappe, L.M. and Dingus, L., *Walking on Eggs: The Astonishing Discovery of Thousands of Dinosaur Eggs in the Badlands of Patagonia*, Scribner, New York, 2001.
4. Dingus, L., Chiappe, L.M. and Coria, R., *Dinosaur Eggs Discovered! Unscrambling the Clues*, Twenty-First Century Books, Minneapolis, MN, 2008.
5. Chiappe and Dingus, ref. 3, p. 18.
6. Chiappe, L.M., Coria, R.A., Dingus, L., Jackson, F., Chinsamy, A. and Fox, M., Sauropod dinosaur embryos from the Late Cretaceous of Patagonia, *Nature* **396**:258–261, 1998.
7. Chiappe, L.M., Schmitt, J.G., Jackson, F.D., Garrido, A., Dingus, L. and Grellet-Tinner, G., Nest structure for sauropods: sedimentary criteria for recognition of dinosaur nesting traces, *Palaaios* **19**:89–95, 2004.
8. Grellet-Tinner, G., Membrana testacea of titanosaurid dinosaur eggs from Auca Mahuevo (Argentina): implications for exceptional preservation of soft tissue in lagerstätten, *J. Vertebrate Paleontology* **25**(1):99–106, 2005.
9. Chiappe and Dingus, ref. 3, p. 201.
10. Schweitzer, M.H., Chiappe, L., Garrido, A.C., Lowenstein, J.M. and Pincus, S.H., Molecular preservation in Late Cretaceous sauropod dinosaur eggshells, *Proceedings of the Royal Society B* **272**:775, 2005.
11. Jackson *et al.*, ref. 1, p. 305.
12. Jackson *et al.*, ref. 1, p. 300.
13. Oard, M.J., *Dinosaur Challenges and Mysteries: How the Genesis Flood Makes Sense of Dinosaur Evidence—Including Tracks, Nests, Eggs, and Scavenged Bonebeds*, Creation Book Publishers, Powder Springs, GA, 2011.
14. Oard, M.J., Evidence of dinosaur nest construction is extremely rare, *J. Creation* **19**(2):21–22, 2005.
15. Oard, M.J., The meaning of porous dinosaur eggs laid on flat bedding planes, *J. Creation* **27**(1):3–4, 2013.
16. Dingus *et al.*, ref. 4, p. 103.
17. Grellet-Tinner, G., Fiorelli, L.E. and Salvador, R.B., Water vapor conductance of the Lower Cretaceous dinosaurian eggs from Sanagasta, La Rioja, Argentina: paleobiological and paleoecological implications for South American faveololithid and megalolithid eggs, *Palaaios* **27**:45, 2012.
18. Barnhart, W.R., Dinosaur nests reinterpreted: evidence of eggs being laid directly into rising water under conditions of stress, *Creation Research Society Quarterly* **41**(2):89–102, 2004.
19. Boyd, S.W. and Snelling, A.A. (Eds.), *Grappling with the Chronology of the Genesis Flood: Navigating the Flow of Time in Biblical Narrative*, Master Books, Green Forest, AR, 2014.

The ‘Great Unconformity’ and associated geochemical evidence for Noahic Flood erosion

Harry Dickens

The Bible’s Flood account describes the greatest rain event ever recorded. Forty days and nights of rain falling on the earth (Genesis 7:12) would have caused immense denudation of landmasses around the globe. Evidence for this is provided by a key stratigraphic surface and by associated geochemical signatures.

Nature and extent of the ‘Great Unconformity’

The term ‘Great Unconformity’ was originally used to describe the prominent stratigraphic surface exposed in the Grand Canyon that separates the Lower Cambrian Tapeats Sandstone (of the Sauk cratonic sequence) from the underlying Precambrian strata (Granite Gorge Metamorphic Suite and tilted sedimentary rocks of the Grand Canyon Supergroup).¹

The Great Unconformity can be traced across North America and globally, including most of today’s southern hemisphere landmasses, along with Western Europe and Siberia—this makes it the “most widely recognised and distinctive stratigraphic surface in the rock record”.² This surface in most regions separates continental crystalline basement rock from overlying undeformed Cambrian marine fossil-bearing sedimentary rock. It thus records the onset of the denudation of continental

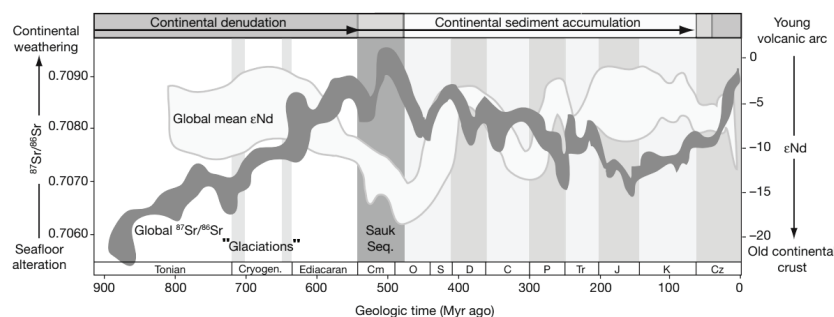


Figure 1. Summary of major geochemical and sedimentary patterns derived from Upper Proterozoic to Phanerozoic strata (modified from Peters and Gaines²)

crust, followed by the first major marine transgression (Sauk Sequence) and sediment accumulation on the continents (figure 1).²

The Great Unconformity is a clear case where uniformitarianism does not apply. Extensive planation surfaces are not forming today but channel erosion is occurring today.³ The very high energy erosion of the global Flood would have had the capacity to wear down Precambrian cratons to simultaneously form the Great Unconformity as a peneplaned surface over tremendous areas of the earth. Most Flood geologists point to this widespread erosional discontinuity in the geological record, known as the Great Unconformity, as indicating the Flood's abrupt onset.⁴

The Sauk Sequence often has quartz and feldspar-rich basal sands overlying Precambrian basement across North America and North Africa.^{2,5} Similarly, basal sandstone units are widespread in the large (2 million km² surface area) Australian intracratonic sedimentary basin known as the Centralian Superbasin, which is believed to have formed at the time of the break-up of the Rodinia supercontinent.⁶ The Heavitree Quartzite is the basal sandstone unit of the Amadeus Basin, which is in turn part of the Centralian Superbasin.⁷ The Heavitree Quartzite has been described as an early Flood formation.⁸

In southern Israel the fossiliferous Cambrian sedimentary strata of the early Flood sit directly on the eroded

surface of the crystalline basement of the northernmost Arabian-Nubian Shield.⁹

Evidence of sea level rise includes a universal fining upward sequence that has been observed in Cambrian and Lower Ordovician strata in locations across the USA (Sauk Sequence), Greenland, UK, Russia, Australia, Bolivia, and Ghana.¹⁰ A classic fining upward succession occurs in Grand Canyon Cambrian strata.¹¹

A Flood model has been proposed to explain the erosion of the Great Unconformity and subsequent deposition of the Cambrian Tapeats Sandstone, Bright Angel Shale, and Muav Limestone as floodwaters advanced in areas now known as Nevada, Arizona, and New Mexico.¹¹

Along with tremendous erosion of the exposed continental landmasses, torrential rain would likely have caused huge mass flows sweeping down into the adjacent seas. Upper Proterozoic mixtites, interpreted by secular scientists as occurring during 'glaciations' (figure 1), are more likely mass flow deposits formed in the early stage of Noah's Flood due to enormous rainfall on the continents.^{12–15} Other Upper Proterozoic mixtites are found in the Appalachian Mountains, Scandinavia, Russian Platform, Siberia, Caledonian Mountains, northwest China, Brazil, central and southern Africa, and northwest, central and southern Australia.¹⁶

Geochemical signatures consistent with continental denudation

Numerous geochemical signatures indicative of continental denudation have been described from Upper Proterozoic strata.^{2,17}

Strong evidence for an increase in continental erosion and weathering products to the global ocean is provided by measurements of Ca²⁺ in fluid inclusions.² Concentrations of Ca²⁺ show a precipitous increase from Upper Proterozoic strata to a peak in Cambrian strata.¹⁸ Much of this near threefold increase in Ca²⁺ has been attributed to greater chemical weathering of continental crust during the Sauk marine transgression.²

The abundance and distribution of the phyllosilicate mineral glauconite, (K,Na)(Fe³⁺,Al,Mg)₂(Si,Al)₄O₁₀(OH)₂, in Cambrian sediments likely required rapid authigenesis due to an unusually large flux of continental weathering products, particularly Fe³⁺, K⁺ and H₃SiO₄, during the formation of the Great Unconformity.² Trough cross-stratified deposits of glauconitic mineral-rich accumulations (glauconites, i.e. coarse-grained glauconitic mineral pellets) found in Cambro-Ordovician strata indicate a high energy environment. The abundance of thoroughly cross-stratified deposits also indicates that, at least on the cross-set scale, individual pellets were deposited and covered by other laminae very rapidly.¹⁹

Precipitation of carbonate sediments also reached a peak in the Phanerozoic, as recorded in the Cambrian-Lower Ordovician strata of the Sauk Sequence of North America.^{20–22} Petrographic textures (displacive growth of calcite crystals within the claystone matrix) and depleted δ¹³C values provide evidence of rapid direct precipitation of carbonate at the sediment-water interface.²³ Calcium carbonate precipitation does not require deep time as has been demonstrated by laboratory studies.²⁴

Thus huge volumes of Cambro-Ordovician carbonate globally could have precipitated rapidly, likely within months during the year of Noah's Flood.

During the early stage of the Flood, the enormous runoff from continents may have contributed to the drawdown of carbon dioxide described for the Cryogenian,²⁵ since chemical weathering of silicate rocks is a major carbon dioxide sink.^{26,27}

⁸⁷Sr is a radiogenic daughter isotope of ⁸⁷Rb and is found in silicate rocks such as granite. The abundance of radiogenic ⁸⁷Sr relative to 'common' ⁸⁶Sr in a sample of sediment is related to the amount of sediment that originated from erosion of continental crust as opposed to that originating from the ocean. The observed increase in Upper Proterozoic strontium isotope ratios ⁸⁷Sr/⁸⁶Sr (figure 1) has been explained by accelerated rates of erosion during the so-called Pan-African orogeny, and high crustal erosion rates have been inferred from Cambrian ⁸⁷Sr/⁸⁶Sr values.²⁸

The subsequent decline in ⁸⁷Sr/⁸⁶Sr ratio in post-Cambrian strata indicates greater oceanic influence and a time of accumulation of sediments on the continents (figure 1) as more of the Sauk Sequence began to be deposited, reducing the direct erosive impact on landmasses. The radiometric 'time-span' for the Upper Proterozoic to Cambrian increase in ⁸⁷Sr/⁸⁶Sr ratio is approximately 400 Ma (figure 1), but in the biblical framework the actual time elapsed would have been of the order of weeks to months.

Final comment

The erosional surface represented by the Great Unconformity is found on continents around the globe and is an exceptional boundary in earth history. This surface commonly separates Precambrian rocks from overlying Cambrian sedimentary strata. Continental denudation, enhanced chemical

weathering, and changes in global ocean chemistry are indicated by numerous geochemical signatures associated with this boundary. The evidence is consistent with what would be expected from the effects of enormous rainfall and rising Flood waters/tsunami-like waves on the continents during the early Noahic Flood.

References

1. Yochelson, E.L., The Lipalian interval: a forgotten, novel concept in the geologic column, *Earth Science History*, **25**:251–269, 2006.
2. Peters, S.E. and Gaines, R.R., Formation of the 'Great Unconformity' as a trigger for the Cambrian explosion, *Nature* **484**:363–366, 2012.
3. Oard, M., *Flood by Design: Receding Water Shapes the Earth's Surface*, Master Books, Green Forest, AR, 2008.
4. Baumgardner, J., Could most of the earth's U, Th, and K have been in the mantle prior to the Flood? *J. Creation*, **26**(3), 47–48, 2012.
5. Clarey, T., Reading African strata, *Acts & Facts* **44**(9), 2015.
6. Allen, P.A. and Armitage, J.J., Cratonic Basins, in *Tectonics of Sedimentary Basins: Recent Advances*, Edited by Busby, C. and Azor, A., Blackwell Publishing, 2012.
7. Lindsay, J.F., Heavitree Quartzite, a Neoproterozoic (Ca 800–760 Ma), high-energy, tidally influenced, ramp association, Amadeus Basin, central Australia, *Australian J. Earth Sciences* **46**:127–139, 1999.
8. Walker, T., The sedimentary Heavitree Quartzite, Central Australia, was deposited early in Noah's Flood, *J. Creation* **29**(1):103–107, 2015.
9. Snelling, A.A., The geology of Israel within the Biblical Creation-Flood framework of history: 1—The pre-Flood rocks, *Answers Research J.* **3**:165–190, 2010.
10. Morton, G.R., Global, continental and regional sedimentation systems and their implications, *Creation Research Society Quarterly* **21**:23–33, 1984.
11. Austin, S.A., A creationist view of Grand Canyon strata; in: Austin, S.A. 1994. *Grand Canyon, Monument to Catastrophe*, Institute for Creation Research, Santee, CA, 1994.
12. Wingerden, V., Initial Flood deposits of the western Northern American Cordillera: California, Utah and Idaho; in: Ivey, Jr., R.L. (Ed.), *Proceedings of the Fifth International Conference of Creationism*, Creation Science Fellowship, Pittsburgh, PA, pp. 349–358, 2003.
13. Sigler, R. and Wingerden, V., Submarine flow and slide deposits in the Kingston Peak Formation, Kingston Range, Mojave Desert, California: evidence for catastrophic initiation of Noah's Flood; in: Walsh, R.E. (Ed.), *Proceedings of the Fourth International Conference on Creationism*, Creation Science Fellowship, Pittsburgh, PA, pp. 487–501, 1998.
14. Snelling, A.A., *Earth's Catastrophic Past: Geology, Creation and the Flood*, Institute for Creation Research, Dallas, TX, 2009.
15. Austin, S.A. and Wise, K.P., The Pre-Flood/Flood boundary: as defined in Grand Canyon, Arizona and eastern Mojave Desert, California; in: Walsh, R.E. (Ed.), *Proceedings of the Third International Conference on Creationism*, Creation Science Fellowship, Pittsburgh, PA, pp. 37–47, 1994.
16. Schermerhorn, L.J.G., Late Precambrian Mixtites: Glacial and/or NonGlacial? *American J. Science* **274**:673–824, 1974.
17. McKenzie, N.R., Hughes, N.C., Gill, B.C. and Myrow, P.M., Plate tectonic influences on Neoproterozoic-early Paleozoic climate and animal evolution, *Geology* **42**(2):127–130, 2014.
18. Brennan, S.T., Lowenstein, T.K. and Horita, J., Seawater chemistry and the advent of biocalcification, *Geology* **32**:473–476, 2004.
19. Chafetz, H.S. and Reid, A., Syndepositional shallow-water precipitation of glauconite minerals, *Sedimentary Geology* **136**:29–42, 2000.
20. Ronov, A.B., Khain, V.E., Balukhovskiy, A.N. and Seslavinsky, K.B., Quantitative analysis of Phanerozoic sedimentation, *Sedimentary Geology* **25**:311–325, 1980.
21. Walker, L.J., Wilkinson, B.H. and Ivany, L.C., Continental drift and Phanerozoic carbonate accumulation in shallow-shelf and deep-marine settings, *J. Geology* **110**:75–87, 2002.
22. Ginsburg, R.N., Actualistic depositional models for the Great American Bank (Cambro-Ordovician); in: *Eleventh International Congress on Sedimentology, Abstracts of Papers*, International Association of Sedimentologists, McMaster University, Hamilton, Ontario, Canada, p. 114, 1982.
23. Gaines, R.R., Hammarlund, E.U., Hou, X., Qi, C., Gabbott, S.E., Zhao, Y., Peng, J. and Canfield, D.E., Mechanism for Burgess Shale-type preservation, *PNAS* **109**(14):5180–5184, 2012.
24. Wojtowicz, J.A., Factors affecting precipitation of calcium carbonate, *J. Swimming Pool and Spa Industry* **3**(1):18–23, 2001.
25. Berner, R.A., GEOCARBSULF: A combined model for Phanerozoic atmospheric O₂ and CO₂, *Geochimica et Cosmochimica Acta* **70**:5653–5664, 2006.
26. Berner, R.A., Lasaga, A.C. and Garrels, R.M., The carbonate-silicate geochemical cycle and its effect on atmospheric carbon dioxide over the past 100 million years, *American J. Science* **283**:641–683, 1983.
27. Kump, L.R., Brantley, S.L. and Arthur, M.A., Chemical weathering, atmospheric CO₂, and climate, *Annual Review of Earth and Planetary Sciences* **28**:611–667, 2000.
28. Derry, L.A., Brasier, M.D., Corfield, R.M., Rozanov, A.Y. and Zhuraylev, A., Sr and C isotopes in Lower Cambrian carbonates from the Siberian craton: a paleoenvironmental record during the 'Cambrian explosion', *Earth and Planetary Science Letters* **128**(3):671–681, 1994.

Little erosion beneath Antarctica and Greenland Ice Sheets

Michael J. Oard

It is generally assumed that continental ice sheets erode the substrate that lies beneath them.¹ If the Antarctic and Greenland Ice Sheets are millions of years old they should show evidence of abundant erosion from the movement of ice. When the base of an ice sheet or glacier becomes ‘cold-based’ (i.e. frozen to its bed), very little erosion takes place. But when the ice sheet thickens enough to exceed the pressure-melting point, or when geothermal heating or melting causes the ice to break free, basal slip occurs, causing subglacial erosion.

According to uniformitarians, the Antarctic Ice Sheet first developed 34 Ma ago, but they acknowledge it could have developed as early as the Late Cretaceous, about 70 Ma ago.² They claim the Antarctic Ice Sheet did not reach a steady-state equilibrium until about 14 Ma ago. For some of that time, we can assume the ice sheet would have been thick enough to reach the pressure-melting point. There should be abundant evidence of erosion during these warm-based episodes from basal slip, plucking, and even meltwater flow.

Likewise, uniformitarian scientists claim the Greenland Ice Sheet originated 38 Ma ago but did not reach steady-state until about 2.7 Ma ago.³ This would mean much of the time the Greenland Ice Sheet was warm-based and underwent numerous warm and cold cycles that would enhance erosion, especially during the warm Late Cenozoic.

Temperatures are believed to have been much warmer in the Arctic throughout almost all the Cenozoic, even the Pliocene. Ellesmere Island was 11–16°C warmer⁴ while the rest of the Canadian High Arctic was 19°C warmer in the Pliocene.⁵ New proxy estimates continue to raise the temperature difference between the Pliocene and today.⁶ The sea level is believed to have been 35 m higher than it is today⁷ with sea surface temperatures in the Arctic Ocean 6–10°C warmer.⁸ Such warm conditions during development of the Greenland Ice Sheet would have resulted in great erosion. Even today, 75% of the Greenland Ice Sheet is warm-based.¹

Assuming uniformitarian science’s ages are accurate, the amount of erosion in the substrate should have been tremendous—corresponding to the millions of years during and after the ice sheets reached equilibrium. However, there is little evidence to suggest massive erosion has occurred beneath these ice sheets.

The surprising Gamburtsev Mountains show little erosion by ice

The Gamburtsev Mountains are located below the centre of the Antarctic Ice Sheet under the highest area of Dome A, which is about 4 km above sea level. The mountain range is about 1,200 km long, about the length of the European Alps. It is believed that the Antarctic Ice Sheet originated in these mountains.⁹

A recent airborne radar survey, completed in early 2009, penetrated through the ice and showed isochronal ice layers, likely caused by volcanic acids, and the basal topography beneath the ice. The remote-sensing data revealed a jagged mountain landscape with sharp peaks and high relief, similar to the Alps.² The relief averages 2.25 km but is up to 4 km along the edges of the mountain chain.

One peak reaches up to within 350 m of the surface of the ice sheet.¹⁰

The radar survey exposed a major problem: the mountains showed little evidence of erosion. If the ice sheet was millions of years old, there should be abundant evidence of erosion. This draws into question the age of the ice sheet, causing one uniformitarian scientist to claim: “But the fact that the mountain peaks have not been eroded into plateaus suggests that the ice sheet could have formed relatively quickly.”¹⁰

To try and solve this conundrum, they suggest that after the formation of the total depth of the ice sheet, the Gamburtsev Mountains became cold-based, although today it is warm-based and has meltwater, and would have been in equilibrium for the past 14 Ma. However, during the formation of the ice sheet over millions of years before 14 Ma ago, the ice sheet would have likely been warm-based. Moreover, the present conditions under thick ice contradict their explanation of it being cold-based for millions of years after reaching its maximum thickness.

Now, greater erosion would certainly be expected near the coast because of fast-moving ice and ice streams. However, even in coastal locations the erosion is mostly focused in linear troughs, similar to fjords, while large tracts of the landscape retain their pre-glacial, slightly dissected erosion surfaces.^{11,12}

The radar also showed a ‘fluvial’ landscape, only partially modified by glaciation. In other words, the valleys and the drainage system were sculpted by water or meltwater and the ice movement had only played a minor role in forming the subglacial terrain.

There are many cirques (figure 1) high in the mountains indicating alpine glaciation began at high altitudes and progressed into the valleys. A cirque is a steep-walled, half-bowl-shaped hollow high on the side of a mountain. The height of these cirques is

commonly over 2 km above sea level.¹³ This elevation measurement takes into account the isostatic adjustment caused by the weight of the ice sheet lowering the elevation of the cirques. This type of alpine glaciation implies the initial conditions of mountain glaciation would have resulted in warm lowlands and coastal temperatures. “We found maximum, minimum and average coastal temperatures of 27.8°C, 16.3°C, and 21.6°C...”.¹⁴ These numbers were projected downward from 2.4 km by assuming cirque temperatures at about 4°C during the start of glaciation and using a standard lapse rate for high latitudes. Lapse rate is the lowering of temperature as the altitude increases. The centre of the developing Antarctic Ice Sheet should have been warm-based for millions of years within the uniformitarian framework and substantial glacial erosion should have occurred.

The centre of the Greenland Ice Sheet also eroded little

Radar images from under the centre of the Greenland Ice Sheet³ also exposed the landscape under the ice. The ¹⁰Be isotope was used to analyze the ‘soil’ within the basal 13 m of the GISP2 ice core, drilled 3,054 m down from the top of the ice sheet.³ The ice core data showed the soil was millions of years old according to the rate of radiometric decay.³ They concluded the base of the Greenland Ice Sheet was non-erosional and cold-based for at least the past 2.7 Ma.³ Uniformitarian glaciologists therefore concluded the centre of the ice sheet never melted during the numerous interglacials of the Pleistocene. Knowing that presently the centre of the ice sheet is cold-based leaves an unanswerable question. How do we know the glacier was also exclusively cold-based between 38 and 2.7 Ma ago, when the Eocene to Pliocene Arctic was much warmer than today? Oxygen isotope ratios indicate



Figure 1. Cirque formed during the Ice Age in the Colorado Rocky Mountains, USA

there were once warmer conditions at the base of the ice sheet, at least during ‘previous interglacials’.³ From this data we can conclude that the Greenland Ice Sheet also developed rapidly, before there was much erosion from the ice sheet.

One issue remaining is that the ¹⁰Be measurements in the soil at the base of the Greenland Ice Sheet were very high when compared to the rate of formation today. The measurements ranged from 0.61 to 3.8 x 10⁸ atoms g⁻¹. ¹⁰Be, like ¹⁴C, is formed by cosmic rays in the atmosphere and is delivered to the surface dirt by either rainfall or the fall of small particles. It accumulates today at a rate of 3.5 x 10⁵ atoms cm⁻² year⁻¹. The high readings in the silt at the bottom of the ice sheet, assuming slow decay and uniformitarianism, imply that the substrate below the ice sheet is millions of years old. However, if the ice sheet is young, the readings imply that before glaciation the land was only about a thousand years old. This is not likely within the young-earth timescale. High concentrations of ¹⁰Be in pre-glacial sediments imply

its formation rate was either very high during the Flood or very high just after the Flood before glaciation, or both. Since cosmic rays are inversely proportional to the earth’s magnetic field strength, high silt concentrations of ¹⁰Be imply there were past times of a lower magnetic field. One outcome of a global Flood is a rapidly fluctuating magnetic field which could explain differences in ¹⁰Be.¹⁵ Or it is possible the high ¹⁰Be measurements are due to an unknown cause.

Troughs in the ice indicate rapid glaciation

More evidence for rapid glaciation is revealed by how little horizontal movement has occurred in the isochronous reflection layers¹⁶ within the ice (figure 2). Troughs in the ice line up vertically with mountain valleys. If the ice were millions of years old, the troughs and ridges in the ice would be bent over in the direction of the ice movement. Either the ice sheet has been cold-based from the beginning, which is less likely for the reasons

mentioned above, or it is very young and consistent with a rapid post-Flood Ice Age. Other locations within the Antarctic Ice Sheet display this same lack of motion.¹⁷

Observations consistent with Flood geology and the post-Flood Ice Age

The new results from the Antarctic and Greenland Ice Sheets are consistent with late-Flood channelized runoff^{18,19} and a rapid post-Flood Ice Age.^{20,21} The pre-glacial ‘fluvial’ pattern in the Gamburtsev Mountains is consistent with Walker’s Dispersive or Channelized Flow Phase of the Flood.^{22,23} The coastal erosion surfaces are consistent with the Abative or Sheet Flow Phase of Flood runoff. The sharp

peaks under the ice sheets attest to youth and not many millions of years of glaciation. Because of warm ocean temperatures right after the Flood, glaciation would have begun in the *mountains* of Antarctica, as well as Greenland. For a time the ocean would have remained warm, also keeping the coast and lowland temperatures relatively warm. Inland temperatures were likely much cooler, so moisture from the ocean would fall as snow in the mountains. It would take a few hundred years for the ocean to cool, mainly from evaporation.^{18,19} Snow and ice would have eventually covered the lowlands and coastal regions. In this scenario, both ice sheets would have formed relatively rapidly, before the substrate was substantially eroded.

References

1. Bierman, P.R., Corbett, L.B., Graly, J.A., Neumann, T.A., Lini, A., Crosby, B.T. and Rood, D.H., Preservation of a preglacial landscape under the center of the Greenland Ice Sheet, *Science* **344**:402, 2014.
2. Rose, K.C., Ferraccioli, F., Jamieson, S.S.R., Bell, R.E., Corr, H., Creyts, T.T., Braaten, D., Jordon, T.A., Fretwell, P.T. and Damaske, D., Early East Antarctic Ice Sheet growth recorded in the landscape of the Gamburtsev Subglacial Mountains, *Earth and Planetary Science Letters* **375**:1–12, 2013.
3. Bierman *et al.*, ref. 1, pp. 402–405.
4. Csank, A.Z., Tripathi, A.K., Patterson, W.P., Eagle, R.A., Rybczynski, N., Ballantyne, A.P. and Eiler, J.M., Estimates of Arctic land surface temperatures during the early Pliocene from two novel proxies, *Earth and Planetary Science Letters* **304**:291–299, 2011.
5. Salzmann, U., Williams, M., Haywood, A.M., Johnson, A.L.A., Kender, S. and Zalasiewicz, J., Climate and environment of the Pliocene warm world, *Palaeogeography, Palaeoclimatology, Palaeoecology* **309**:1–8, 2011.
6. Ballantyne, A.P., Greenwood, D.R., Sinninghe Damsté, J.S., Csank, A.Z., Eberle, J.J. and Rybczynski, N., Significantly warmer Arctic surface temperatures during the Pliocene indicated by multiple independent proxies, *Geology* **38**(7):603–606, 2010.

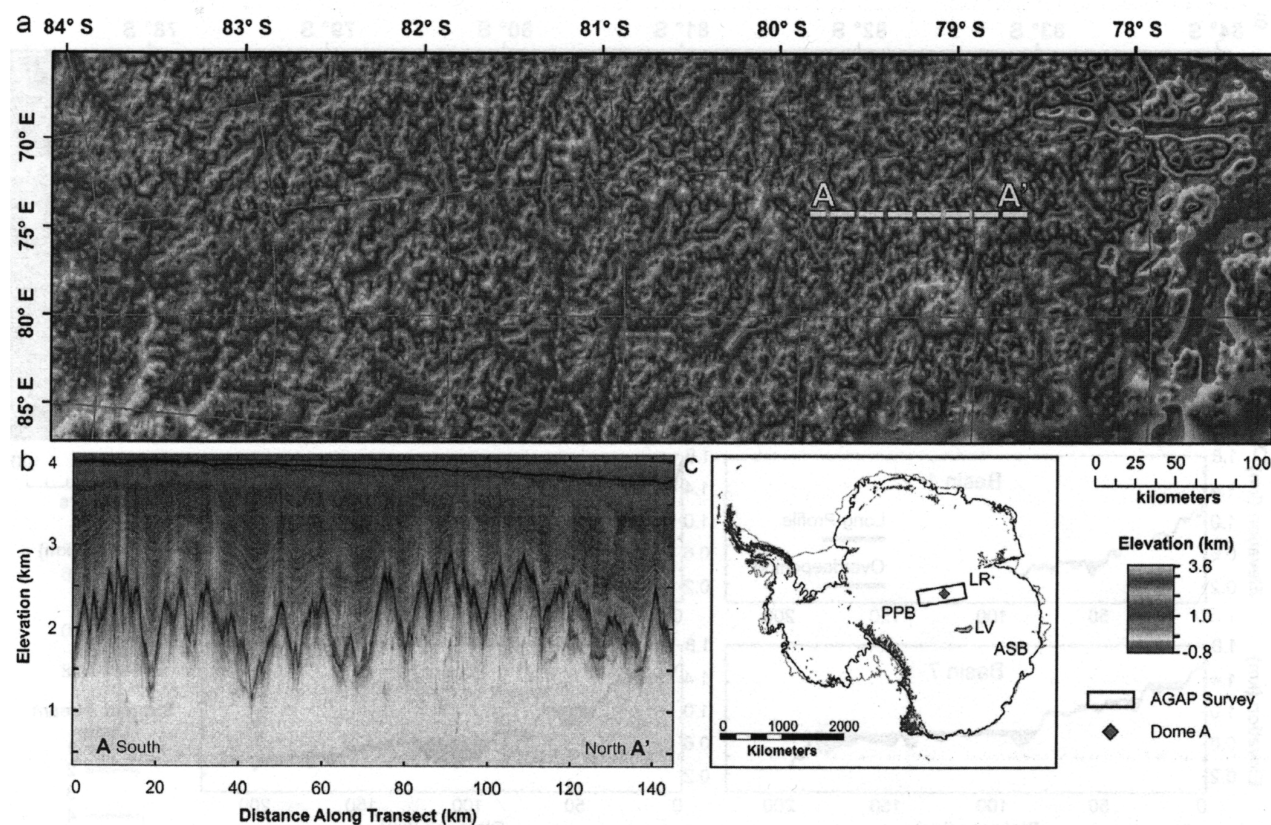


Figure 2. Subglacial topography of the Gamburtsev Mountains showing not only the sharp peaks and little-eroded landscape, but also little movement of the ice sheet over hundreds of thousands of years within the uniformitarian timescale, as shown by the isochronous layers in white that are vertical above the bedrock features (from Rose *et al.*²).

7. Ballantyne, A.P., Rybczynski, N., Baker, P.A., Harington, C.R. and White, D., Pliocene Arctic temperature constraints from the growth rings and isotopic composition of fossil larch, *Palaeogeography, Palaeoclimatology, Palaeoecology* **242**:188–200, 2006.
8. Pagani, M., Liu, Z., LaRiviere, J. and Ravelo, A.C., High Earth-system climate sensitivity determined from Pliocene carbon dioxide concentrations, *Nature Geoscience* **3**:27–30, 2010.
9. en.wikipedia.org/wiki/Gamburtsev_Mountain_Range, accessed 24 October 2014.
10. Walker, A., planetearth.nerc.ac.uk/news/story.aspx?id=740, 2010.
11. Rose, K.C., Ross, N., Jordan, T.A., Bingham, R.G., Corr, H.F.J., Ferraccioli, F., Le Brocq, A.M., Rippin, D.M. and Siegert, M.J., Ancient pre-glacial erosion surfaces preserved beneath the West Antarctic Ice Sheet, *Earth Surface Dynamics* **3**:139–152, 2015.
12. For more information on the global distribution of erosion and planation surfaces, see references 16 and 17.
13. Rose *et al.*, ref. 2, p. 6.
14. Rose *et al.*, ref. 2, p. 9.
15. Humphreys, D.R., Reversals of the Earth's magnetic field during the Genesis Flood; in: Walsh, R.E., Brooks, C.L. and Crowell, R.S. (Eds.), *Proceedings of the First International Conference on Creationism*, Volume II, technical symposium sessions and additional topics, Creation Science Fellowship, Pittsburgh, PA, pp. 113–126, 1986.
16. Vaughan, D.G., Corr, H.F.J., Doake, C.S.M. and Waddington, E.D., Distortion of isochronous layers in ice revealed by ground-penetrating radar, *Nature* **398**:323–326, 1999.
17. Oard, ref. 21, pp. 135–138.
18. Oard, M.J., *Flood by Design: Receding Water Shapes the Earth's Surface*, Master Books, Green Forest, AR, 2008.
19. Oard, M.J., michael.oards.net/GenesisFloodRunoff.htm, 2013.
20. Oard, M. J., *Frozen in Time: Woolly Mammoths, the Ice Age, and the Biblical Key to Their Secrets*, Master Books, Green Forest, AR, 2004.
21. Oard, M.J., *The Frozen Record: Examining the Ice Core History of the Greenland and Antarctic Ice Sheets*, Institute for Creation Research, Dallas, TX, 2005.
22. Walker, T., A biblical geologic model; in: Walsh, R.E. (Ed.), *Proceedings of the Third International Conference on Creationism*, technical symposium sessions, Creation Science Fellowship, Pittsburgh, PA, pp. 581–592, 1994.
23. bibleageology.net/.

Naturalistic origin of the moon comes under hard times

Michael J. Oard

Science built on naturalism has always struggled with the origin of our nearest neighbour, the moon. Three competing ideas have previously been suggested, only to be all be shown to be highly improbable.¹ These comprise the fission theory, in which the moon separated from the earth; the capture theory, in which the earth captured a wandering moon; and the condensation theory, in which the earth and moon formed from the condensation of the same dust cloud. Researchers rarely leave a theoretical vacuum. After these ideas were disproved, planetary scientists invented the idea that the moon formed after a collision between the earth and a Mars-sized object. It is called the ‘giant impact hypothesis’ and has been the reigning model for the past 30 years. Some have come to believe this hypothesis as a fact.

Moon too similar to Earth to be caused by a giant impact

Computer models have been invoked to simulate the giant impact, but they have always had difficulty in correctly simulating the impact origin of the moon, although there has been a little success in ‘modelling’ physical parameters that must be explained.^{2,3} However, the identical isotopes of various elements between the earth and the moon indicate that the giant impact hypothesis has serious problems.^{4,5} In September of 2013, researchers gathered at the Royal Society to do an in-depth review of the origin of the moon and concluded that the giant impact hypothesis is highly unlikely

based on the geochemical and other problems:

“Following almost three decades of some certainty over how the Moon formed, new geochemical measurements have thrown the planetary science community back into doubt. We are either modelling the wrong process, or modelling the process wrong.”⁶

Astronomers are discovering more and more that the geochemistry of the moon is almost exactly that of the earth:

“A crisis in the field has been created by the growing realization that the Moon and Earth are exceptionally similar in composition—so similar, in fact, that the emerging constraints are difficult for the giant impact hypothesis to meet. ... The Earth and Moon seem to share identical isotopic signatures in oxygen, iron, hydrogen, silica, magnesium, titanium, potassium, tungsten and chromium. ... That all these isotopic compositions are the same on the Earth and Moon, to high precision, places stringent constraints on physical scenarios for making the satellite.”⁷

Such exactness defies the giant impact hypothesis because models have concluded that most of the moon should have been created from the debris of the impactor, and therefore the geochemistry would be significantly different.⁷

Many models ... no solution

Many models have attempted to form the moon from a giant impact by varying the parameters, such as size, velocity, and impact angle, of the impactors.^{8–10} After many model runs, an acceptable isotopic similarity between the moon and Earth has been simulated. The models had to rely on a special Earth–moon–sun resonance to decrease substantially the very high angular momentum of the early Earth. However, these moon origin simulations are simple models, and adding more complexity to the

models will be a major challenge.³ For instance, after the collision a homogenous vapour is supposed to have evolved with the same isotopic ratios of many elements. However, some elements, such as titanium, would condense out too quickly to produce the same isotopic ratio between the earth and moon.^{3,7} The decrease in angular momentum of the Earth–moon system by resonance with the sun depends upon the ‘thermal state’ of the system, which can only be guessed at.³ Moreover, there are other problems with the simple idea of resonance: “The tidal heating and flexing of the hot young moon so near the earth may, however, prevent capture into these orbital resonances”.⁷

Where does that leave naturalistic theories on the origin of the moon? Apparently, there is no credible alternative at the moment, and extreme, untested physics seems to be required:

“The simulations of a Moon-forming impact have yet to produce a moon that fits all the puzzle pieces, geochemical and otherwise. ... We are attempting to model processes of physics that are extreme as compared to current Earth conditions. We have never observed these processes in nature or in the laboratory.”⁷

Older theories are still seen as implausible:

“Competing hypotheses, such as fission of the moon from a de-spinning earth or capture of an unrelated Moon into orbit around earth, do not fit as many of the required constraints, and require special pleading on several fronts.”¹¹

It seems that the main reason scientists have been unable to explain even the closest body to the earth, the moon, is their naturalistic worldview:

“we want to explain our Moon and earth as the outcome of a common and reasonable process”.⁷ The failure of naturalistic models is implicit support for the Genesis record of creation of the moon by God on the 4th day of creation, an idea unfortunately unthinkable to naturalists.

References

1. DeYoung, D. and Whitcomb, J., *Our Created Moon: Earth's Fascinating Neighbor*, Master Books, Green Forest, AR, 2003.
2. Elliott, T., Shadows cast on Moon's origin: a chip off the old block, *Nature* **504**:90, 2013.
3. Stewart, S.T., Shadows cast on Moon's origin: a chip off the old block: weak links mar lunar model, *Nature* **504**:90–91, 2013.
4. Oard, M.J., Problems for ‘giant impact’ origin of moon, *J. Creation* **14**(1):6–7, 2000.
5. Samec, R.G., Lunar formation—collision theory fails, *J. Creation* **27**(2):11–12, 2013.
6. Elkins-Tanton, L.T., Occam's origin of the Moon, *Nature Geoscience* **6**:996, 2013.
7. Elkins-Tanton, ref. 6, p. 997.
8. Cuk, M. and Stewart, S.T., Making the Moon from a fast-spinning earth: a giant impact followed by resonant despinning, *Science* **338**:1047–1052, 2012.
9. Canup, R.M., Forming a Moon with an Earth-like composition via a giant impact, *Science* **338**:1052–1055, 2012.
10. Halliday, A.N., The origin of the Moon, *Science* **338**:1040–1041, 2012.
11. Elkins-Tanton, ref. 6, p. 998.



Figure 1. The near side of the moon

Strong defence of the biblical Adam

God, Adam, and You: Biblical Creation Defended and Applied

Richard D. Phillips (Ed.)

P&R Publishing, Phillipsburg, NJ, 2015

Lita Cosner

At a time when it is common for professing evangelicals to deny the importance of the historical Adam and biblical creation, it is refreshing to see a group of pastors and teachers come together to defend the Bible's account of creation and human origins. *God, Adam, and You* is a book with six contributors who have written ten chapters looking at the subject from different viewpoints, and explaining its vital importance in Christian doctrine and church life.

Pastoral and theological views

One of the characteristics that makes *God, Adam, and You* stand out is that it is written by pastors and theological professors. Most of creation apologetics is dominated by scientists and specialists who have made creation the focus of their ministry. Hearing a defence from people who spend most of their time pastoring and teaching brings out some unique elements, which is helpful. Their teaching experience also helps to make the points of the book understandable to laypeople.

Unfortunately, this lack of specialization also means that the authors occasionally fall back on arguments most creation apologists no longer use, such as creation with 'appearance of age' or starlight created in transit (p. 7). Another author equates the

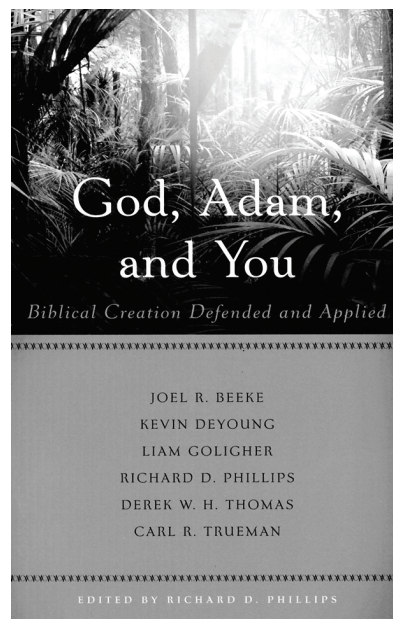
created kinds with the species (p. 87), while yet another posits that the speed of light may have been faster in the past (p. 129). This shows that while pastors and teachers definitely have something to teach specialists in creation apologetics, the reverse is definitely true as well.

What difference does Adam make?

The first chapter is by Joel Beeke, President of Puritan Reformed Theological seminary where he is Professor of Systematic Theology and Homiletics, as well as a pastor of Heritage Netherlands Reformed Congregation. He argues that "Sometimes people will attempt to graft the word *Adam* onto a concept that is quite foreign to the Scriptures" (p. 15), and affirms the importance of the biblical presentation of who Adam was. While affirming the real pressures in the current academic environment to deny the historical Adam, he documents that Scripture presents Adam as the literal first man, the ancestor of everyone else who ever lived, and his Fall as a real historical event. He asks: "If Adam was not a real man, who else was not?" (p. 25). He adds:

"What about Moses or David? They also appear in historical narratives in the Bible. They are listed in genealogies. They are spoken of as real people by our Lord Jesus. If all that evidence is not enough to prove that Adam was a historical figure, then why should we believe that any of them were historical figures?" (p. 26).

He goes on to note Adam's importance when it comes to important biblical doctrines, and calls the historical Adam "a test case for biblical authority"



(p. 36). He criticizes those who deny the historical Adam:

"They deny that the Bible says anything authoritative about scientific matters. On the contrary, they treat modern science as the eyeglasses by which we should read the Scriptures, so that through our scientific knowledge we can sift out God's message from the erroneous beliefs of the ancient community of faith" (p. 37).

Two views of the human person

Kevin DeYoung, the senior pastor of University Reformed Church, argues that our view of human origins makes a tremendous difference in how we think of human ontology, dignity, and destiny. He shows how creation indicates that there is purpose for human existence and humans have inherent worth because they are in the image of God. He also argues that a biblical view of the Fall of mankind is the only accurate diagnosis of humanity's sin problem. Most importantly, a biblical view of human origins gives us an accurate view of what believers can look forward to in heaven—the

restoration of the original ‘very good’ creation (Genesis 1:31).

Adam, Lord of the garden

In his chapter, Liam Goligher, Senior Minister at Tenth Presbyterian Church in Philadelphia, argues that God made Adam a priest in the Garden of Eden, and Adam would have functioned as a mediator of a covenant for his offspring, had he not sinned. He draws some helpful parallels between the Garden of Eden and the Tabernacle, but non-Reformed readers might take exception to reading so much of the language of covenant into the Edenic relationship with God.

Nevertheless, there are good theological insights into some of the dynamics of what happened in the Fall. There was a total reversal of the created authority structure, with an animal instructing the woman, who then led her husband into sin (pp. 75 ff). Another point that is vital to biblical creationist apologetics concerns death as the result of sin:

“So when sin appears, it appears as an intruder into the garden. ... Evil is not a necessary component of the material and physical world. ... People today who think that Adam was some kind of tribal chieftain whom God selected and chose to use ignore the fact that this means there was sin and evil before Adam, because there was death before him. And that means that sin is built into the very nature of humanity. But in the Bible’s account, sin is an alien intruder” (p. 75).

The Bible and evolution

Richard Phillips, senior minister at Second Presbyterian Church in Greenville, SC, and chairman of the Philadelphia Conference on Reformed Theology, shows how the Bible and evolution present mutually exclusive views of origins and how compromise inevitably affects the integrity of the

Bible’s entire storyline. Evolution destroys any coherent view of the authority of Scripture and mankind in God’s image, as well as destroying the teaching that death is the consequence of sin.

Phillips talks about the pastoral implications of an evolutionary view of death:

“When a man or woman stands over the bed of his mother watching her die, Christianity no longer says that this is wrong, that this is opposed to God, that this is an enemy that God has vowed to overcome and destroy. ‘The last enemy to be destroyed is death’ (1 Cor. 15:26), says the Bible. But informed by evolution, the Christian instead thinks that only spiritual death is the result of the fall. The death of a child or parent or friend is no longer in itself a great evil opposed by God. Because of the doctrine of evolution, Christians must abandon in principle our position as people of life and join the secularist culture with its callous acceptance of the fundamental necessity and virtue of death. To deny this shift is merely to avoid the implication of what the theory of evolution is: a description of human progress by means of the death of those deemed inferior. Death is the instrument by which evolution works, and it must be embraced as essentially good in the worldview shaped by evolution. A religious position more opposed to Christianity is hard to imagine” (pp. 96–97).

But even more significantly, an evolutionary view implies Adam did not exist, or at the very least he cannot have the relationship to humanity that the Bible claims. This undermines Paul’s argument in 1 Corinthians 15 and Romans 5:

“The very argument that Paul makes about Adam, sin, and death is fundamentally at odds with evolution’s version of history. If this is the Bible’s doctrine of salvation,

it addresses a sin problem that is mythical, not historically real. On what basis may we conclude that the Christian gospel is itself anything other than another ancient myth, designed to address a problem that we know has no connection to the world described by evolutionary science?” (pp. 98–99).

God’s design for gender, marriage, and sex

This chapter by Richard Phillips uses the creation of mankind as male and female to promote a complementary view of men’s and women’s roles in marriage. While not all readers will agree with his complementary viewpoint, they can nonetheless appreciate his point that abandoning a biblical view of mankind as male and female as the foundation for marriage, including romance and sexual relationships, opens the door to all sorts of unbiblical practices such as androgyny and gay ‘marriage’.

Differing views on the days of creation

Derek Thomas, Professor of Systematic and Pastoral Theology at Reformed Theological Seminary and minister at First Presbyterian Church in Columbia, SC, surveys all the possible views on the days in Genesis, giving the strengths and weaknesses of each view. He is perhaps a little too charitable to some of the old-earth views, and repeats their usual misunderstanding of the Galileo affair, but comes down squarely in the young-earth camp for his own view. Unfortunately, he prefers what he calls an “apparent age” view (p. 128), where God created the earth to look old, rather than the view that geological activity around the time of the Flood shaped the earth as we see it today. He also gives too much credence to c-decay (p. 129). However, his young-earth view takes the days of creation

seriously, the genealogies literally with no or few gaps, and one can commend him for choosing a view that respects “the most straightforward reading of the text in accordance with its genre as historical narrative” (p. 139).

Christ, the second Adam

In Christian writing, there is a tendency to refer to Jesus as ‘the second Adam’. This is an error (strictly speaking, *Noah* seems to be presented as the second Adam,¹ and then there were a variety of people with Adam-like vocations who all failed); Jesus is the *last Adam* (1 Corinthians 15:45)²—the one who succeeded where all the other Adams failed. But regardless of Joel Beeke’s error with regard to the precise terminology, his chapter makes some good points.

Christ as the last Adam restored all that the first Adam lost; He succeeded where the first Adam failed. He withstood the serpent’s temptation in a wilderness while the first Adam succumbed in a garden paradise. The first Adam bequeathed death to all his descendants because of his sin, while the last Adam gives life to all who believe. The first Adam died bodily, the last Adam was bodily resurrected—as those who believe in Him will be.

From God’s garden to God’s city

Richard Phillips traces the similarities between the Garden of Eden and the New Heavens and earth, emphasizing that the story of Scripture is one of *restoration*. This logically implies returning at least to a perfect state from which we fell. He discusses the statement in Revelation 21:1 that there will be no more sea, and interprets it in a figurative sense, meaning that the chaos and destruction symbolized by the sea will be no more (p. 174). But even more importantly, God not only restores His creation, but His people, who will live with Him forever.

Original sin and modern theology

The chapter by Carl Trueman (Professor of Historical Theology and Church History, Pastor of Cornerstone Presbyterian Church in Ambler, PA), oddly, is an exact copy of his chapter from *Adam, The Fall, and Original Sin*.³ He takes on the treatment of the doctrine of Original Sin in modern theology and how it has largely been ignored by liberal theologians. Trueman chooses six theologians who have jettisoned a belief in the historical Adam and Eve and Original Sin, and shows what happens to one’s overall theology when this foundational doctrine is rejected. He gives a brief summary of the beliefs of Friedrich Schleiermacher, Walter Rauschenbusch, Karl Barth, Rudolph Bultmann, Reinhold Niebuhr, and Wolfhart Pannenberg. He notes similarities in their theology:

“First, all of them repudiate any notion that humanity stands guilty before God because of the imputation of an alien guilt, the guilt of a historical man called Adam, to all of his descendants. ... Second, all of the theologians reject the relevance of the historicity of Adam” (p. 207).

This had disastrous consequences for the theology of all of the surveyed theologians and serves as somewhat of a cautionary tale for those who would compromise in this critical area.

Scripture as authority

One refreshing quality of the writing in *God, Adam, and You* is the presupposition that Scripture actually addresses whether Adam was a real historical human being. All the authors have a commitment to honour what Scripture says, not in some nebulous way that allows them to discard the testimony of Scripture, but by actually believing it and incorporating it into their worldview.

One product of this view is that the book is overwhelmingly based in biblical theology, rather than science or philosophy. While philosophy or science might be used as supporting evidence, the main arguments of all the authors come from the words of Scripture itself.

The writing styles of the authors are pleasant and easy to read. This makes the book appropriate for laypeople interested in the topic. However, an index would have been helpful, especially of scriptural references.

The book’s authors all come from a Reformed tradition and occasionally they make statements in line with Reformed theology that other Christian groups may disagree with (this is particularly the case in Liam Goligher’s chapter, “Adam, Lord of the Garden”).

All in all, though there are several statements most biblical creationists might disagree with, their overall message of the Bible’s authority regarding creation is one that all Christians should agree on.

References

1. Batten, D., Adam and Noah: two beginnings, *Creation* 34(1):12–14, 2011; creation.com/adam-and-noah.
2. Cosner, L., Christ as the last Adam: Paul’s use of the Creation narrative in 1 Corinthians 15, *J. Creation* 23(3):70–75, 2009; creation.com/1-corinthians-15.
3. Madueme, H. and Reeves, M., (Eds.), *Adam, the Fall, and Original Sin: Theological, Biblical, and Scientific Perspectives*, Baker Academic, Grand Rapids, MI, 2014. See review by Cosner, L., The vital importance of the historical Adam, *J. Creation* 29(3):19–22, 2015.

Irreconcilable records of history and muddled methodology

40 Questions About Creation and Evolution

Kenneth D. Keathley and Mark F. Rooker

Kregel Publications, Grand Rapids, MI, 2014

Nick Sabato

Authored by two professors at Southeastern Baptist Theological Seminary, with “one leaning to young-earth creationism (Rooker) and the other to old-earth creationism (Keathley)” (p. 23), this book is a new addition to Kregel’s ‘40 Questions’ series. Having previously addressed many of Ken Keathley’s objections to biblical (‘young-earth’) creationism,¹ in this review I will briefly touch on additional arguments with a focus on the foundational errors in their approach to the Genesis record.² Although Professor Rooker is ‘young-earth leaning’, one would not get that impression from the overall tenor of the book.³ Keathley’s old-earthism dominates, and though the authors repeatedly admit that the face-value reading of Genesis lends itself to six-day creation and a global Flood, such an exegesis is made to reside in perpetual conflict with the empirical evidence.

Some notable contributions

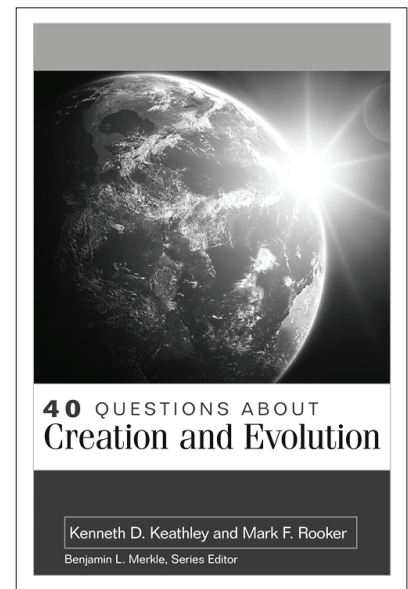
It is worth mentioning that, despite its overarching concessions to old-earthism, the book is not without merit. There are portions where young-earth creationists would wholeheartedly

agree, and some of the authors’ observations are insightful. Providing substantial summaries of various old-earth positions, including valuable criticisms of common old-earth arguments, the book is most suitable as a reference. Though ‘young-earth creationism’ is not cast in a very good light, the authors do, in fact, echo many of the sentiments put forth by YECs against the more popular old-earth ideas. Concerning the gap theory, for example, they write:

“Genesis 1:2 has nothing to do with ‘chaos’ and simply means ‘emptiness’ and refers to the earth which is an empty space, i.e., ‘an unproductive and uninhabited place. ... Western Bible commentaries written before the eighteenth century, before the belief in an old age for the earth became popular, knew nothing of any gap between Genesis 1:1 and Genesis 1:2. ... Exodus 20:11 affirms that everything in heaven and earth and in the sea was made in six days” (p. 117).

The authors point out that Exodus 20:11 likewise opposes the day-age view. They note that “if each day represented billions of years, then the question would be raised as to what took place in the evening (dark). How could animals have survived billions of years in darkness before the light of the next day?” (p. 125).

Responding to Framework advocates, the authors affirm that “the creation account of Genesis 1:1–2:2 gives every indication of being a typical Hebrew narrative” (p. 131), and, “Exodus 20:11 and 31:17 indicate that the creation days are normal twenty-four hour days” (p. 133). “If Moses was trying to emphasize and



focus on chronology and sequence in the creation account, it is difficult to imagine a clearer presentation than what we find in Genesis 1:1–2:3” (p. 134).

The discussion of ‘work’ in relation to the Fall and the Sabbath is insightful and relevant (chapters 9 and 10). They also point out that God’s ‘resting’ is His ceasing to create; this in opposition to the idea of an ongoing seventh day. Also, they point out that this first occurrence of the number seven found in the work week “sets the pattern for the significance of the number seven throughout the remainder of Scripture” (p. 95).

Commendably, Keathley and Rooker take the time to explain the importance of affirming a historical Adam and Eve and a literal Fall. They write:

“We believe the historicity of Adam and Eve is so important that the matter should serve as a litmus test when evaluating the attempts to integrate a proper understanding of Genesis 1–3 with the latest findings of science. It must be realized that any position which denies that a real fall was experienced by a real couple will have adverse effects on

The timeframe in years from Adam's creation to Abraham's birth, based on event-to-event timeframe 'links' as recorded in Genesis					
Timeframe "Links"	Bookend Events	Womb Time	Stated Years	Partial Year	Total Years
1. Genesis 5:3	Adam is created/ Adam begets Seth	n/a	130	≤ 1	≤ 131
2. Genesis 5:6	Seth is begotten/ Seth begets Enosh	≤ 1	105	≤ 1	≤ 107
3. Genesis 5:9	Enosh is begotten/ Enosh begets Cainan	≤ 1	90	≤ 1	≤ 92
4. Genesis 5:12	Cainan is begotten/ C. begets Mahalaleel	≤ 1	70	≤ 1	≤ 72
5. Genesis 5:15	Mahal. is begotten/ M.begets Jared	≤ 1	65	≤ 1	≤ 67
6. Genesis 5:18	Jared is begotten/ Jared begets Enoch	≤ 1	162	≤ 1	≤ 164
7. Genesis 5:21	Enoch is begotten/ E.begets Methusaleh	≤ 1	65	≤ 1	≤ 67
8. Genesis 5:25	Methusaleh is begotten/ Methusaleh begets Lamech	≤ 1	187	≤ 1	≤ 189
9. Genesis 5:28–29	Lamech is begotten/ Lamech begets Noah	≤ 1	182	≤ 1	≤ 184
10. Genesis 7:6	Noah is begotten/ Flood hits	≤ 1	600	≤ 1	≤ 602
11. Genesis 11:10	Flood hits/ Arphaxad is begotten	n/a	2	≤ 1	≤ 3
12. Genesis 11:12	Arphaxad is begotten/ A.begets Shalah	≤ 1	35	≤ 1	≤ 37
13. Genesis 11:14	Shalah is begotten/ Shalah begets Eber	≤ 1	30	≤ 1	≤ 32
14. Genesis 11:16	Eber is begotten/ Eber begets Peleg	≤ 1	34	≤ 1	≤ 36
15. Genesis 11:18	Peleg is begotten/ Peleg begets Reu	≤ 1	30	≤ 1	≤ 32
16. Genesis 11:20	Reu is begotten/ Reu begets Serug	≤ 1	32	≤ 1	≤ 34
17. Genesis 11:22	Serug is begotten/ Serug begets Nahor	≤ 1	30	≤ 1	≤ 32
18. Genesis 11:24	Nahor is begotten/ Nahor begets Terah	≤ 1	29	≤ 1	≤ 31
19. Genesis 11:26	Terah is begotten/ Abraham is born	≤ 1 + ≤ 1 ³⁸	70	≤ 1	≤ 73
			Total ≥ 1,985		Total ≤ 1,985

Figure 1. Adam-to-Abraham Timeframe Data (Institute for Creation Research). Excerpted from: Johnson, J.J.S., How young is the earth? Applying simple math to data in Genesis, *Acts & Facts* 37(10):4, 2008.

other significant biblical doctrines” (p. 237).

To all of this we say, ‘Amen’. At this point one might wonder how the old-earth paradigm still triumphs in light of the above. Unfortunately, despite the authors’ admission that a straightforward exegesis of Genesis points to a literal six-day creation (p. 134) and global Flood (p. 310), they still appear to uphold deep time. No solution is offered to reconcile the two conflicting histories. It is unclear how extrabiblical deep time is to be embedded into a history constrained by a chronology of biblical events. What is clear, however, is that in many places conventional naturalistic interpretations of scientific evidence go unchallenged, and a quasiempiricism is substituted for biblical presuppositionalism. The authors’ *exegetically-young yet geologically-old* model remains elusive.⁴

The Fall, animal death, and theistic evolution

Chapter 25 contains a helpful discussion of the Fall and the events surrounding it. Here, the authors affirm the importance of the Fall both historically and theologically. The following chapter, however, addresses animal death and places its origin antecedent to the Fall. One must bear in mind that such a discussion is itself relevant only because of a prior acceptance of geological eons interposed on the biblical narrative.⁵ Keathley and Rooker appear to find no difficulty accepting animal death as intrinsic to God’s creation, and believe that while “the no-death position argued by YEC proponents seems to have biblical warrant, ... that does not mean it is exegetically or theologically necessary” (p. 261).

There are too many problematic statements in this chapter to address them all.⁶ To summarize, YECs would object to the authors’ assertion (in chapter three) that “the Bible tells us that we are related to the animals, but

we are not merely animals” (p. 39).⁷ Nowhere in the book do the authors make a definitive case for theistic evolution, yet neither do they exclude it as a possibility. The contention that “we are related to the animals”, and their arguments for pre-Fall animal death certainly seem to be born of a view sympathetic toward theistic evolution.^{8,9}

As usual with old-earth compromisers, they overlook the huge problem that old-earth dating methods entail *human* death long before the Fall, and by sinful means such as cannibalism. Creationists have long pointed out this problem, while old-earthers either overlook it or pretend that indisputable *Homo sapiens* fossils are not really human.¹⁰

Adding to the confusion are statements like the following: “One has to admit that evolutionary creationists present an impressive cumulative case” (p. 362) and “Beyond reasonable doubt genetic evidence primarily, and fossil evidence secondarily, establishes the reality of biological evolution (*that* evolution happened)” (p. 374). But because of earlier discussions in the book concerning ‘micro’ versus ‘macro’ evolution (pp. 313–314), one cannot be entirely certain how the word ‘evolution’ is being used here. This also demonstrates their unfamiliarity with informed creationist scientists, since these generally advise against the ‘micro’ and ‘macro’ distinction. This is because the issue is not *size* of change but its *direction*—whether it increases information or decreases it or is neutral.

The extent of the Flood

After concluding chapter 29 acknowledging the global extent of the Flood (“God is starting over again with humanity”... “the flood episode ... enveloped the whole earth” (p. 284)), and admitting that “the flood account at face value [describes]

a worldwide catastrophe” (p. 290), the authors nevertheless go on to present their case for a *local* flood. Their subsequent arguments are too numerous to address here, some of which have already been shown as deriving from a failure to understand laws of nature in terms of God’s providence, and the difference between the conceptual geologic column and the actual rock record.¹

Subsequent to delivering a series of arguments against a global Flood and blasting YECs for arguing their position dogmatically (which is apparently “misguided and detrimental to the health of the church and the cause of Christ” (p. 308)),¹¹ their conclusion is that “Global flood and local flood adherents do agree on one important point: Noah’s flood happened—it is a historical fact” (p. 310).

As will be shown, it is the authors’ epistemological method that is most disconcerting. This is the crack in the foundation that has allowed the local flood waters in to erode the perspicuity and authority of Scripture. Put plainly, “a Christian epistemology ... is based on [the] principle that knowledge is revealed, propositional, and non-contradictory.”¹² Keathley and Rooker, however, have not only gone beyond what is written (1 Cor. 4:6) but have put far too much stock in the wisdom of fallen man by alluding to *empiricism* (“old-earth creationists ... concede that they allow the findings of science to influence the way they approach the creation account in Genesis” (p. 21)). Thus, their assertions are both *compromised* (by wrongly interpreting general revelation, as it is inherently non-propositional) and *contradictory*: “The conclusion must be that, though a cursory reading of Scripture would seem to indicate a recent creation, the preponderance of empirical evidence seems to indicate otherwise” (p. 224).

“So after examining the biblical and geological evidences, what can be

concluded? Biblically ... a natural reading seems to give more weight to the global model. Geologically, the evidence argues for the local flood interpretation” (p. 310).

Of course, the secular geology to which they surrender doesn’t even allow any real local flood.

Gaps in the genealogies

It is curious that the authors give so much attention to supposed genealogical gaps. As any old-earth proponent could attest, the presence of gaps in the genealogical record could not accommodate the vast ages required by the standard geological timescale. Regardless, it has been shown that even if *gaps in name lists* do exist they would not permit any significant extension of the chronology, since they provide “*event-to-event* timeframes”¹³ (figure 1), especially between the births of the named patriarchs.

It appears that Keathley and Rooker may be holding the door open for the passage of time on more than one occasion, perhaps hoping to account for the seemingly immutable geologic timescale. The authors also have concerns that not all of the recorded events on Day 6 could have happened in a twenty-four hour period. This obstacle, coupled with additional time wedged into the genealogies, may help to make room for deep time. Whether this is actually the reason the authors have for asserting ‘telescoping’ and truncated genealogies is unclear since they also admit that, despite the presence of gaps, “not an enormous amount of time has passed since the beginning of creation” (p. 176).

The authors take many opportunities, such as the above examples, to cast doubt on the YEC position. Old-earth advocates, theistic evolutionists, and ID proponents are cast in a better light than those who simply take the Genesis text at face value.¹¹

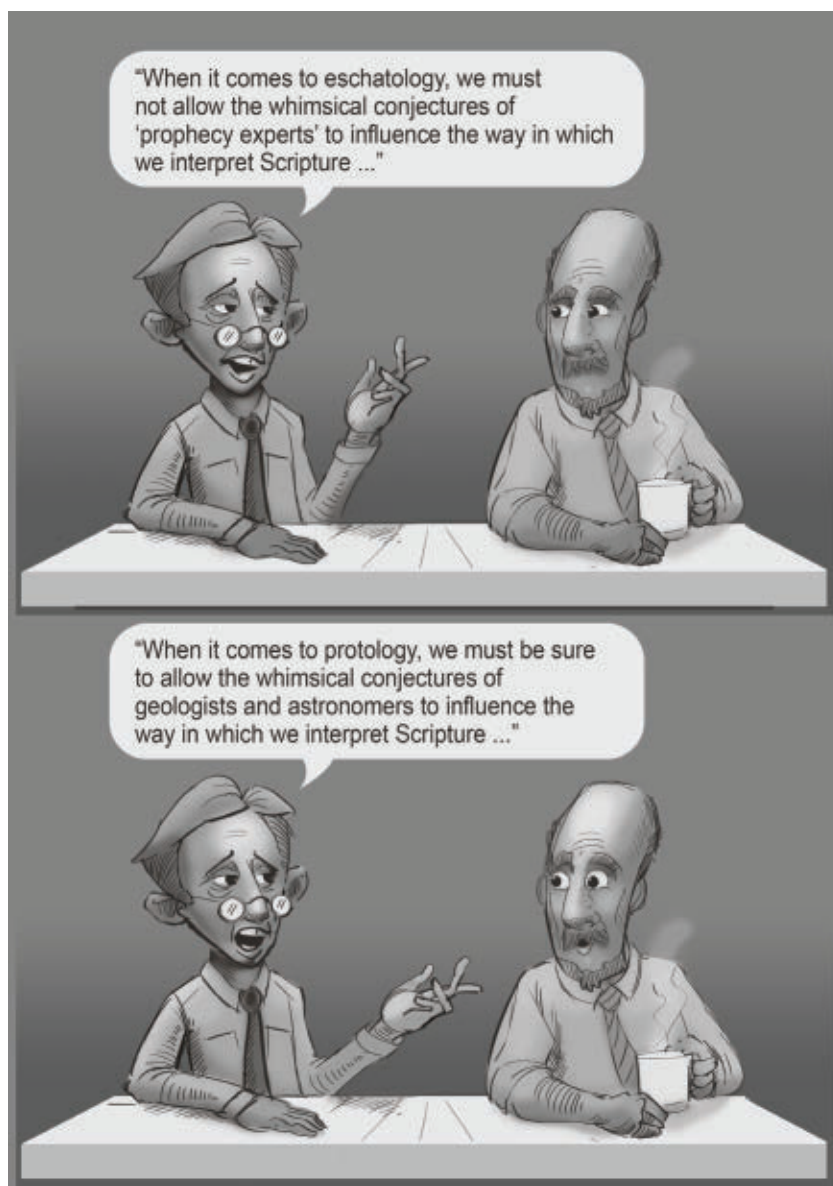


Figure 2. The inconsistency with which Christians employ the Reformation principle of *sola scriptura* often goes unnoticed. This is particularly apparent when it comes to discussions on the subjects of protology and eschatology.³²

Functionally mature creation

Keathley and Rooker particularly take issue with any so-called appearance of age in creation. First, they argue that such a notion is ‘extra-biblical’ because one “cannot point to a single passage of Scripture that actually states that God created the world with an appearance of age” (p. 220). It is baffling why the authors exhibit concern over the extra-biblical

concept of a ‘mature creation’ while the extrabiblical (and antibiblical) concepts of deep time and restricted flooding pose no such difficulty for them. Certainly, a functionally mature creation is a necessary consequence of creation *ex nihilo*.¹⁴

A related concern is their treatment of natural laws devoid of a consistent, biblical worldview. This is evident in their handling of radiometric dating as well. When the laws of nature become

primary (and not regarded as simply a component of God’s providence^{15,16}) it is easy to draw conclusions that do not correspond to reality. The true history of the universe is understood by simply accepting the propositions of Scripture; propositions which provide no support for billions of years or localized flooding.

Fideism or presuppositionalism?

A careful reading of chapter one reveals that the epistemological method employed by the authors is not one in which Scripture is given its proper place as the fountainhead of all knowledge. Their admitted reliance upon empiricism (pp. 21–22) paves the way for concessions to ‘scientific evidence’ throughout the rest of the book.

According to Keathley and Rooker, YECs are not the presuppositionalists they often claim to be but rather fideists for accepting the plain teaching of Scripture without considering evidence from nature.¹⁷ Such an assertion requires that one redefine both of those terms. Typically, fideism has been understood as faith *without* reason, ‘a bare irrational faith’.¹⁸ Adler described fideism as a “commitment to a body of religious dogmas And if certain religious dogmas appear to be absurd or unreasonable in the light of secular knowledge, the fideist redoubles his commitment to them, not merely in spite of their being absurd, but precisely because they are absurd.”^{19,20}

Presuppositionalism, on the other hand, involves accepting the Protestant axiom that “the Bible and the Bible alone is the Word of God, and it has a systematic monopoly on truth.”²¹ Therefore, if biblical presuppositionalism is the epistemological starting point, scientific evidence and sense experience must not be permitted to play a role in the evaluation or interpretation of Scripture, much less could they have the authority to call into question the Bible’s plain record of history.²² Yet the authors admit

that “old-earth creationists [of whom Keathley is one] ... concede that they allow the finding of science to influence the way they approach the creation account in Genesis. Philosophically, they follow more closely in the tradition known as *empiricism* [emphasis in original]” (p. 21).²³

Keathley and Rooker believe that a presuppositionalist must re-evaluate his axioms in light of empirical evidence (pp. 20–21)²⁴ and in turn reduce YECs to fideists for their unwillingness to do so.²⁵ Clearly the principle of *sola scriptura* is not being employed by any such old-earth empiricist (figure 2).

It is important to note that, according to Keathley and Rooker, “Christian theists start with the presupposition of supernaturalism ... , the view that reality is greater than nature. God transcends the universe and is its Creator” (p. 18). But this is an entirely inadequate axiom for the Christian. ‘Supernaturalism’ as such does not identify the Creator and does not ascribe to Him (or Her, for that matter) an authoritative, written revelation that God verbally inspired (i.e. God ensured that the human authors, using their own styles, wrote the words that God wanted to be written without error). Such a presupposition of supernaturalism could just as easily be embraced by Muslims—there is nothing distinctively biblical about it. A Christian should begin “by presupposing Scripture as the absolute authority for all human reasoning and knowledge”²⁶ (table 1).

Had the authors advanced presuppositionalism they would have eliminated their own justification for believing in an old earth. But since ‘supernaturalism’ could not logically preclude an interaction with empiricism, and having denounced the biblical creationists’ approach as fideism, the Bible loses its position of absolute authority concerning the doctrine of creation and the Flood. Why then should it retain its authority when it comes to the great historical

Table 1. By embracing an ambiguous supernaturalism and appealing to empiricism, Keathley and Rooker have departed from the historic Protestant approach to hermeneutics and apologetics.³³

Philosophical Naturalism	Positivist. Presupposes that the physical world is all that exists. “Supernatural excluded from scientific explanation by definition”. ³⁴
Fideism	Faith without reason. “Faith and reason are in separate, nonoverlapping circles God bypasses the intellect”. ³⁵
Presuppositionalism	<i>Sola Scriptura</i> . The Bible alone is the Word of God. “... There is no authority higher than God’s Word (<i>Hebrews</i> 6:13; <i>John</i> 8:14). [It] must be our axiomatic starting point.” ^{36,37}
Supernaturalistic Empiricism (Keathley and Rooker)	There is a Creator God. Other presuppositions must be retooled or adjusted in accordance with empirical evidence (p. 18).

event which occurred at Calvary? Or, what would empiricism have to say about the Resurrection?

Concluding remarks

In an age where ecumenism, irrationalism, dialectical tension and faltering between two opinions have become the hallmarks of academia,^{27,28} Keathley and Rooker’s approach will likely be warmly received. Now, one can simply admit that the plain reading of Scripture supports a young earth and global Flood while simultaneously embracing deep time.²⁹ Since the rise of neo-orthodoxy, blatant contradictions have often been termed ‘paradoxes’, thus prompting no further investigation or criticism.³⁰

Keathley and Rooker³¹ advocate a ‘mediating position’ favourably quoting the following statement by Bruce Waltke: “To be sure the six days in the Genesis creation account are our twenty-four-hour days, but they are metaphorical representations of a reality beyond human comprehension and imitation” (p. 164). I suppose the vast geological eons can fit themselves comfortably into the metaphorical representation beyond human comprehension. Unfortunately, such preposterousness often passes for profundity. And, since all compromise positions have been shown to fail by doing injustice to the biblical text, affirming two contradictory histo-

ries simultaneously may be the most satisfying ‘solution’ for those impressed with empiricism but unwilling to renounce inerrancy openly.

In the authors’ defence, and as Keathley reminded me in his email, the book is intended to be an overview of various creationist positions. It is not a commentary on the book of Genesis and the authors never promised a systematic defence of their position(s). As providing a summary of various perspectives and the common objections raised against them the book is of considerable value. However, the reader must be content to accept the dichotomy between a fairly honest exegesis on one hand and a capitulation to the wisdom of fallen man on the other. Most significantly, the authors’ epistemological method is not one which should be followed by the Christian who claims to stand on the authority of the Bible.

Acknowledgments

I wish to thank the editor and anonymous reviewers for many helpful comments, corrections, and suggestions. I am also indebted to them for information pertaining to Rooker’s ‘young-earth’ position as it is stated elsewhere, and clarification regarding the ‘functionally mature creation’ argument.

References

1. Sabato, N., A theologian's disappointing departure from biblical creation, *J. Creation* 28(3): 120–127, 2014.
2. The authors make a concerted effort to distinguish between 'the doctrine of creation' with its 'unchangeable tenets', and 'creationism' (p. 17), which is castigated for its uncompromising stance on a 'young' earth. Once again, no comprehensive position can be ascertained from the authors' decidedly non-committal approach to answering many of their own questions.
3. But it is consistent with his other writings, e.g. refuting Bruce Waltke's compromising views, Rooker, M.F., Genesis 1:1–3: Creation or re-creation? Part I, *Bibliotheca Sacra* 149:316–323, 1992; Part II, 149:411–427, 1992; www.academia.edu/1369844/The_Genesis_Flood.
4. A lack of exegetical substrate for Keathley's old-earth position was deemed problematic for his 22-page paper (see ref. 1). How much more so for a 400-page book devoted to the doctrine of creation?
5. Obviously, if there were no vast eons of prehistory leading up to the creation of Adam and Eve, there would be no place for animal death before the Fall. With animals created on Days 5 and 6 and the Fall occurring on, say, Day 10, as James Ussher held (*The Annals of the World* (1658), Master Books, Green Forest, AR, p. 18, 2003), pre-Fall animal death is irrelevant as the fossil record could not be interpreted as predating our first parents.
6. In terms of 'theological necessity', certainly the anthropological significance of the Fall is of greater importance, but belief in pre-Fall animal death is still no trivial matter. See Sarfati, J.D., *The Genesis Account*, pp. 379, 387, 396–398, CPB, 2015. See also Lightner, J.K., Are insects alive? *Creation Matters* 20(1):4–5, 2015.
7. Sarfati, ref. 6, pp. 249–252.
8. Pre-Fall animal death proponent Ronald Osborn similarly speaks of "our brothers and sisters in the animal kingdom". Osborn, R.E., *Death Before the Fall: Biblical Literalism and the Problem of Animal Suffering*, IVP Academic, p. 175, 2014, as cited in Kao, G.Y., Responding theologically to animal ferocity and suffering, *Syndicate* 1(3):102, 2014. Pre-Fall animal death is consistent with Osborn's "evolutionary understanding of the creation that sees animal predation and suffering in terms of principles of freedom and indeterminacy rather than notions of a post-fall 'curse' that supernaturally transforms placid vegetarians into ferocious predators." Osborn, R.E., A response, *Syndicate* 1(3):111, 2014.
9. See also refutation of Osborn, Cosner, L., No straight answers on animal death before the Fall, *J. Creation* 29(2):43–46, 2015.
10. Lubenow, M., Pre-Adamites, sin, death and the human fossils, *J. Creation* 12(2):222–232, 1998; creation.com/pre-adamites.
11. Ironically, after blasting YECs for their unwillingness to allow science to impinge on their hermeneutical method, Keathley and Rooker praise theistic evolutionists Deborah and Loren Haarsma, boasting that "their candor and commitment to Scripture is refreshing" (p. 385).
12. Cooke, R., *Sola Scriptura and the Rebellion in the Modern Church*, Truth International Ministries, Max Meadows, VA, p. 22, 2006.
13. Johnson, J.J.S., Genesis data add up to a young earth; in: *Creation Basics & Beyond*, ICR, Dallas, TX, p. 52, 2013.
14. Bergman, J., The case for the mature creation hypothesis, *CRSQ* 48(2):174–75, 2011.
15. Reed, J.K. and Williams, E.L., Battlegrounds of natural history: naturalism, *CRSQ* 48(2):165, 2011.
16. "The term *natural law* does not reflect God's sovereign government of the universe. Only laws of God exist for us. It is meaningless to speak of God violating natural law when all of natural law is under his governance to begin with. The laws of nature are simply the expression of God's will. The laws of nature are not rules that prescribe how God must act; God is not subject to his own creation. In God's providence, he preserves and governs all things by the word of his power. Therefore, we can only speak of a miracle as being above and beyond natural law but never a violation of natural law. ... The world is not an independent mechanism of natural law." Nelson, P.S., *Presuppositionalism: A Biblical Approach to Apologetics*, FirstLove Publications, Dublin, CA, p. 244, 2014.
17. Merely admitting that one has presuppositions does not make one a presuppositionalist in the apologetic sense (particularly as defined by Clark). This is obvious, since it is well known that many naturalists admit to their own presupposition that the physical world is all that exists.
18. Downing, W.R., *A Catechism on Biblical Doctrine*, FirstLove Publications, Dublin, CA, p. 29, 2008.
19. Adler, M.J., *The Difference of Man and the Difference it Makes*, Holt, Rinehart and Winston, NY, p. 285, 1967.
20. From the full context of his work, it seems likely that Adler himself may not have understood (or been aware of) the distinction between fideism and biblical presuppositionalism, but his definition of the former clearly reveals how biblical presuppositionalism (properly defined) could hardly be construed as 'believing because it is absurd'. Note also, this oft-quoted phrase from Tertullian was actually following Aristotle's teaching on rhetoric, as James Moffat points out: "Aristotle's point is that, with regard to incredible events which are supposed and asserted to have taken place, you may argue that they would never have been believed at all, unless they had actually occurred; such statements must be true or almost true." Moffat, J., Aristotle and Tertullian, *J. Theological Studies* 17:170–171, 1916.
21. Crampton, W.G., *By Scripture Alone: The Sufficiency of Scripture*, The Trinity Foundation, Unicoi, TN, p. 147, 2002.
22. Kulikovskiy, A.S., *Creation, Fall, Restoration: A Biblical Theology of Creation*, Christian Focus Publications Ltd., Fearn, Scotland, p. 50, 2009.
23. "This doctrine of man as the image of God should be sufficient to convince Christian apologetes to reject empiricism. The theory that all knowledge arises out of sensation ... implies we were born with a blank mind." Clark, G.H., *In Defense of Theology*, The Trinity Foundation, Unicoi, TN, p. 54, 1984. Obviously, such a view cannot coexist with presuppositionalism and its implications, including a proper view of the Fall's effects on man's mind.
24. Not only does such a view destroy the meaning of presuppositionalism, but this approach also ignores the noetic effects of sin. "Presuppositional Apologetics assumes the inability of man to rightly interpret any fact because of the depravity of his mind. ... In evidentialism, a capitulation is made to adopt the worldly philosophy of secular empiricism and the ultimacy of man's reasoning." Nelson, ref. 16, pp. 190–191.
25. It is ironic that the one charging YECs with fideism is found favourably quoting the father of existentialism, Kierkegaard, "The King and the Maiden", an illustration of what happened at the Incarnation, is posted on Keathley's website: theologyforthechurch.com/?p=845, 23 December 2014.
26. Nelson, ref. 16, p. 107.
27. "The dialectical ['theologians'] of neo-orthodoxy ... taught that two opposing thoughts could be held in the mind at the same time. They called this feat 'dialectical tension'. So this great term 'dialectical tension' not only gave rise to all kinds of contradictory statements being made but, even worse, it destroyed the perspicuity of Scripture, the basis of true systematic theology." Cooke, ref. 12, p. 23.
28. "Who embraces the middle? Obviously, it is those who reject extremes. It is those who are sensible, respectable, whose judgment is sound. It is those who think carefully and critically. In short, the middle is a very comfortable place for scholars; it matches the scholarly disposition." Lloyd, V., *The rhetoric of the middle*, *Syndicate* 1(3):58, 2014.
29. For instance: "The fundamental tenet of the day-age theory is that the creation of the universe took place over long periods of time. *While this point may be conceded due to the abundance of scientific evidence*, Carl F.H. Henry made the important observation that neither Christians nor secularists believed in the vast antiquity of the universe before the nineteenth century" [emphasis added] (p. 123).
30. "In [the] 'theology of paradox', God can even teach us through false statements. Contradiction is even asserted by Brunner to be the hallmark of truth." Crampton, W.G., *The Scripturalism of Gordon H. Clark*, The Trinity Foundation, Unicoi, TN, p. 24, 1999.
31. I am perfectly willing to be corrected as to what their position(s) actually are, but I am constrained to use the information which the authors have made available, which includes a personal email exchange with Keathley [dated 3/8/2015]. Again, if Rooker does indeed lean towards young-earth (p. 23), he does not (in this book) call into question, for instance, the legitimacy of the standard geologic timescale.
32. Batten, D., End-times and early-times, *Creation* 27(4):43, 2005.
33. Despite the existence of various apologetic approaches which fit the description of 'presuppositionalism', I think it is safe to say that no presuppositionalist would object to the primary axiom I have provided here. Evidentialism has intentionally been left out of the table for the sake of simplicity, and because it was not directly addressed by the authors anyway but obfuscated with empiricism and presuppositionalism.
34. Reed and Williams, ref. 15, p. 148.
35. Morley, B.K., *Mapping Apologetics*, IVP Academic, Downers Grove, IL, pp. 13, 16, 2015.
36. Crampton, ref. 21, p. 84.
37. See also Reymond, R.L., *The Justification of Knowledge*, Presbyterian and Reformed Publishing Co., Phillipsburg, NJ, pp. 13–15, 1979.
38. "Gestation time is included for both Terah and Abraham, since the timeframe being measured is from Adam's creation to Abraham's birth."

25

of confidence, lack of comprehension, or lack of ability that made him do this? Did he feel, perhaps, that such torrents of words from more competent authors might be more convincing to his readers? On the whole, they aren't. They just make the job of reading his book all that more tedious. I am reminded of Proverbs 17:27: "A man of knowledge uses words with restraint." A science writer needs to consume large amounts of published work (Wiles has done that) but then digest it down to something more palatable to a target audience. Wiles has just regurgitated it all, to no audience in particular.

In a section in which he should have some first-hand experience, on antibiotic resistance in bacteria, he tells us that 'superbugs' arise only in hospitals that use the strongest antibiotics, and they lose their virility when having to compete with wild strains and no antibiotics are present. Sounds good. But right in the middle of this discussion Wiles makes a prediction from his 'Law of Coding' which he claims the evidence confirms, when in fact it is falsified (p. 227). His Law of Coding is just a restatement of Francis Crick's 'Central Dogma of Molecular Biology' (that information passes from DNA to RNA to protein but not in reverse). Wiles claims it has proven with time to be true, but it hasn't. Bacteria use proteins (enzymes) to splice foreign DNA into and out of their genomes, sampling the genetic environment and using any sequences that prove advantageous. This is the basis of lateral gene transfer, it is mediated by proteins, and has been observed in a multitude of examples. Microbiologist James Shapiro called this 'natural genetic engineering' and he published his 2011 book *Evolution: A View from the 21st Century*³ with the express purpose of refuting Crick's Central Dogma. Although severely criticized by neo-Darwinists,⁴ Shapiro's numerous examples and cogent arguments far outweigh his critics'

simplistic appeals to ignorance regarding the true power of random neo-Darwinian origination.⁵

Wiles' error becomes clearer when we examine his prediction in detail:

"If Neo-Darwinian evolution was indeed true, it might be envisaged that a sophisticated bacterium would develop a switching mechanism in its epigenome to turn the pumps on and off in the presence of antibiotics. ... This has not been described to date. This lack of ability to develop switches in the epigenome is predicted by the Law of Coding, as it would require sending information the wrong way up the intracellular information pathways, which cannot happen (p. 227)."

His prediction is wrong for at least two reasons. First, because genetic switching is the foundation of gene regulation and many different examples of gene regulatory rearrangements are known.⁶ As a general principle, "Bacterial adaptation to new environments typically involves reorganization of gene expression",⁷ which means 'reorganization of gene switching sequences'. Second, his use of the word 'epigenome' is incorrect. His glossary entry defines it as "supervisory (meta-) information within the genome of living organisms that carries the instructions for how a cell is to grow and function". The National Human Genome Research Institute defines it as: "The epigenome is made up of chemical compounds and proteins that can attach to DNA and direct such actions as turning genes on or off, controlling the production of proteins in particular cells",⁸ and they give as illustrations DNA methylation and histone modifications.

Wiles' definition more correctly fits the 'regulatory genome' described in the 2006 book *The Regulatory Genome: Gene Regulation in Development and Evolution* by Caltech's International Biology Prize-winning developmental biologist Eric Davidson. The regulatory genome is

what makes a chimpanzee—rather than a human—out of a chimp genome that is supposedly similar to that of humans. The regulatory genome is explicitly genomically encoded and does not include epigenomic phenomena like DNA methylation and histone modifications (although the two are not totally independent). The regulatory genome consists of: (1) gene switches (*cis*-regulatory modules) which are segments of DNA directly upstream of protein-coding genes; (2) protein transcription factors that bind to *cis*-regulatory modules and either initiate or repress transcription of DNA into protein-making mRNA; (3) long segments of regulatory RNA derived from non-protein coding sections of the genome which modulate the timing and rate of transcription factor activity; (4) microRNAs from the same source that fine-tune transcription factor activity; and (5) looping patterns in chromatin structure that can bring remote parts of the genome together to jointly contribute to the regulatory activity.

Does it matter that Wiles is a little bit wrong on these subjects? His failure to understand his subject becomes more evident in his glossary definition of 'evo devo': "Evolutionary Developmental Biology: the study of how embryogenesis might have evolved within Darwinian Theory." He puts the cart before the horse. Evo devo begins with developmental biology, a subject with a long and illustrious history of experimental investigation and award-winning discoveries. It is very solid science. Evo devo then views developmental biology from an evolutionary viewpoint to try to imagine how the great variety of developmental systems may have evolved. Evo devo is not tied to Darwinian Theory, as Eric Davidson discovered, but few people seem to want to listen. His dramatic discoveries led him to conclude: "This concept [the basal stability of the hierarchical regulatory genome] cannot be accom-

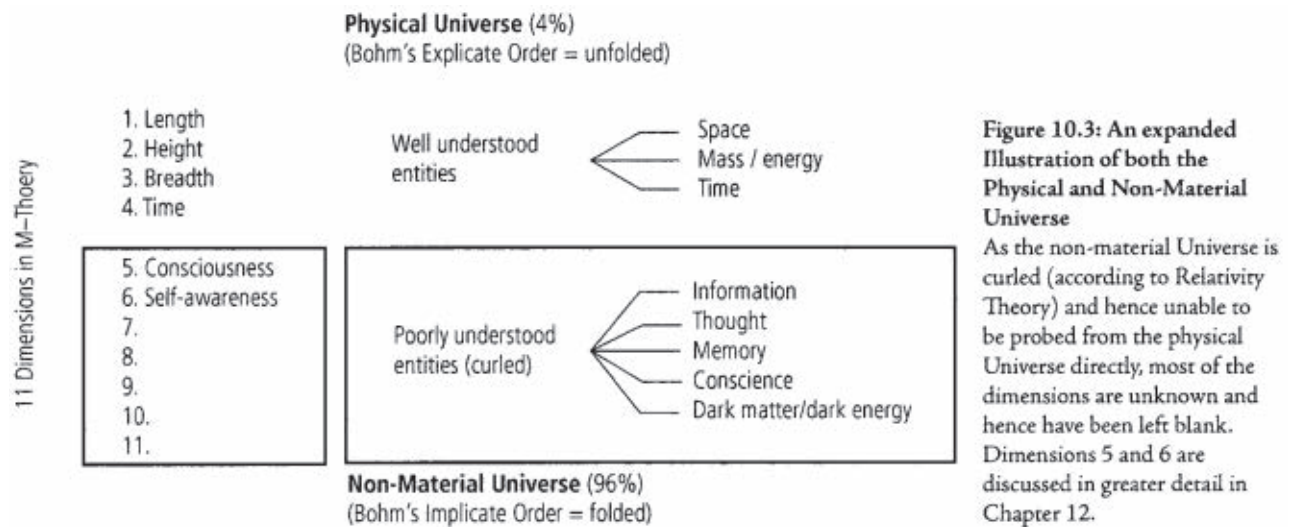


Figure 1. Wiles' summary diagram of the physical and non-material universe, revealing confusion and confounding of concepts. Examples include: curvature of spacetime in General Relativity is confused with tightly curled extra dimensions in string theory; denial that non-material entities such as information and memory can be probed from the physical universe; implicit acceptance of theoretical concepts (M-theory, dark matter, dark energy) as if they are real.

modated by microevolutionary nor macroevolutionary theory.”⁹ So yes, it does matter that Wiles is wrong about his Law of Coding because it is the very first principle in his understanding of information flow in the cell (chap. 3).

Information flow in cells can be properly understood only through the concept of the regulatory state of the cell. The regulatory state is the entire set of factors that determine the state the cell is in at any particular time. It is perhaps best illustrated by considering an egg and sperm prior to fertilization. Both contain approximately the same (haploid) genomes. The sperm is specially configured by its regulatory genome to be a sperm (which is its regulatory state), and the egg is specially configured by its regulatory genome to be a vastly larger egg (which is its regulatory state). After fertilization we now have a zygote, the first cell of a new diploid individual organism. The sperm genome and the egg genome must each be stripped of all their previous specializations as sperm and egg cells so they can adopt the regulatory state of a totipotent zygote. But if all regulatory information is

stripped away, how does the new zygote know how to launch itself into embryogenesis? The answer is that everything is provided in the regulatory state of the mother's egg cell—and that is why the egg is so huge compared to the sperm. The egg is packed with maternal regulatory RNAs and ribosomes, while the sperm is just a packet of mostly chromosomes. The direction of the most important information flow in cells is therefore from parent *cell* to daughter *cell*, not from DNA to RNA to protein.

Wiles' self-published book inevitably invites comparison with other self-published books in this field. Walter ReMine's excellent 1993 book, *The Biotic Message: Evolution versus Message Theory*,¹⁰ ingeniously used only the words of evolutionists to assess their own claims. The result is easy to dip into for specific information and is still worth reading at length today. John Sanford's 2008 book, *Genetic Entropy & The Mystery of the Genome*,¹¹ is also excellent because the author is an international specialist in the field about which he writes, his points are succinctly and clearly made, and he includes criticisms with answers at the

back. Vance Nelson's excellent books,¹² *Dire Dragons* and *Fast Fossils*, are the result of meticulous original research and a high standard of publication quality. In comparison, Wiles' effort is one long tedious argument, ineptly made.

Conclusion

Would I recommend the book to readers of this journal? Perhaps, if you pretend the title is something like: *My adventures in trying to explain evolution to my kids*. That way readers might expect what they actually get. It might be something useful to read in the holidays, if the font size doesn't bother you. After all, three and a half consecutive pages of quotations from Paul Davies (for example) is always worth reading because Davies is a good author and knows his subject, even if I might disagree with him sometimes. Most of Wiles' other quotations are also from worthy writers. But for myself? I wouldn't waste my time getting eye strain. Sorry Robert.

Meanwhile, here are some words that were of great value to me. They were contained in a gracious manuscript

rejection letter I received from Cambridge University Press: “It is a very competitive field.” Schrödinger made the cut—his book was reissued by Cambridge University Press in 1992 with a foreword by Sir Roger Penrose OM, FRS, and again in electronic format in 2012. He did not make a fool of himself.

References

1. Schrödinger, E., *What is Life? The physical aspect of the living cell*, Cambridge University Press, p. 1, 1944.
2. Creation Book Publishers, Atlanta, Georgia, 2011.
3. Financial Times Press Science, Upper Saddle River, NJ.
4. See critical references 16–25 at: en.wikipedia.org/wiki/Natural_genetic_engineering, 14 August 2015.
5. Shapiro, J.A., Response to Pauline Hogeweg’s review of my book, “Evolution: a view from the 21st century”, *Evolutionary Intelligence* 5:211, 2012.
6. Carroll, S.B., *Endless Forms Most Beautiful: The new science of evo devo*, Norton, New York, 2005.
7. Lambert, G. and Kussell E., Memory and fitness optimization of bacteria under fluctuating environments, *PLoS Genetics* 10(9):e1004556, 2014.
8. genome.gov/27532724, accessed 14 August 2015.
9. Erwin, D.H. and Davidson, E.H., The evolution of hierarchical gene regulatory networks, *Nature Reviews Genetics* 10:141–148, 2009.
10. St Paul Science, St Paul, MN.
11. FMS Publications, New York, 3rd edn.
12. untoldsecretsofplanetearth.com/home.html, accessed 14 August 2015.

An atheist rubs shoulders with creationists

**Among the Creationists:
Dispatches from the Anti-
Evolutionist Front Line**

Jason Rosenhouse

Oxford University Press, New York, 2012

John Woodmorappe

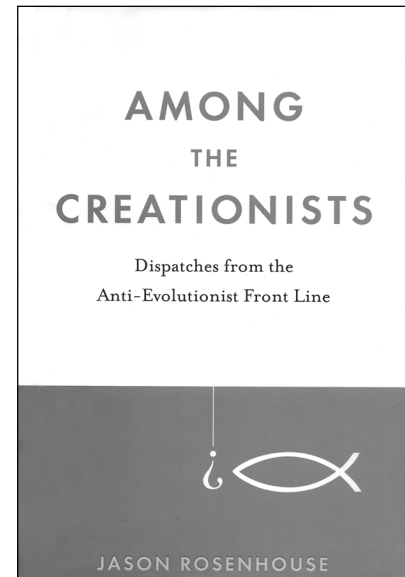
Jason Rosenhouse is Associate Professor of Mathematics at James Madison University in Virginia, USA. His book differs from other anti-creationism tomes in that the author spent a lot of time in conversation with creationists and other Christian believers. His book is experience-oriented more than issue-oriented.

A major shortcoming of this book is the tendency of the author to bring up some matter, and variously express a series of gratuitous opinions, or repeat the arguments of some cited evolutionist work, without analyzing them in any way. He also seems to follow a double standard, as discussed later.

The author’s anti-theism

Rosenhouse seems to go out of his way to keep reminding the reader that he does not believe in God (e.g. pp. 8, 14, 20, 181, 210). He expresses this in the light of his Jewishness:

“I love that for all my mordant atheism I am not even one whit less Jewish than the most orthodox rabbi ... Do I believe that God made a covenant with my ancestors in which we agreed to live by certain implausible laws in return for the land of Israel? Of course not. That idea is *ridiculous* [emphasis in original]” (pp. 181–182).



This is not to say that the author would necessarily like to see the end of religion. Rather, he would like it divested of all supernaturalism, and transformed into a purely cultural practice. As an example, he cites the Scandinavian nations, where many people profess to be Christians and get baptized, but very few actually believe it. As a further example, he delights in the experience he had, soon after the 9/11 terrorist attacks on New York, during a discussion session at his synagogue: “At no point did *anyone* bring up God, or implore people to pray, or raise theological questions about evil, or suggest that the victims of the attacks had, at least, gone to a better place. It made me proud to be a Jew [emphasis in original]” (p. 181).

Does Scandinavia prove the irrelevance of God?

In common with many atheistic authors that I have recently read, Rosenhouse brings up the Scandinavian nations as models. They are

the ones where religion is minimal, and yet the people are prosperous, content, and largely free of crime and other obvious maladies. This, to him and other atheists, proves, at very least, that belief in God is not necessary for happiness, public order, and morality.

To begin with, what can we infer from a people that are prosperous, content, and generally free of grotesque moral flaws? It is entirely possible to be that way while being inwardly wretched, poor, and miserable (Revelation 3:17). In fact, a spirit of indifference to God is perhaps the greatest sin of all. Besides, prosperity and outward morality in this life, by itself, tells us little about the state of one's soul. Finally, the moral character of a people is not fully disclosed when things are going well: The character of a people is demonstrated when there is adversity.

Permit a few iconoclastic comments. There is evidence that the Scandinavian nations are not quite the secularist cradle-to-grave socialist paradises they are made out to be. For instance, in Denmark, the rate of alcoholism among young people is very high.¹ In addition, researchers Jepsen *et al.*² comment: "Denmark has one of the highest alcohol consumption rates in Northern Europe."

The Scandinavian countries, perhaps in large part because they are welfare states (which itself may be a form of immorality), have some of the highest divorce rates in the world.³ Still other notable problems can be identified in the atheistic Scandinavian model societies.⁴

Furthermore, it seems that the Scandinavians are still living on the 'interest' of Christian 'capital', including strong family cohesion and a 'Protestant work ethic'. This has carried over to Americans descended from Scandinavians generations ago, who today earn an average income 20% higher than the American norm. Historically, the rise of the Scandinavian economies occurred in the few decades before WW2; e.g. Sweden

had the fastest economic growth in the developed world between 1870 and 1936. Conversely, the economy has stagnated since secularist welfarism was introduced—Sweden sank to 13th out of 28 industrialized nations between 1936 and 2008.^{5,6}

An evangelistic rally

Rosenhouse attended a preaching event by famous evangelist Luis Palau (pp. 16–17). He complained that Palau did not give any evidences for the factuality of his message (as if he was supposed to). Rosenhouse said he felt completely unstirred by Palau's message and could not understand why people were so visibly moved. He fully expected Palau to get no response to the altar call and expressed amazement that people did come forward. In reflecting upon Rosenhouse's attitude, I could not help but think of 1 Corinthians 2:14, where we are told that the natural man does not receive the things of God, because they are foolishness to him.

Philosophy of religion

The author delves into the philosophy of religion. He cites, and briefly discusses, the works of some philosophers.

As an example, Rosenhouse brings up the so-called problem of suffering and evil, and God's existence. He says that the "We cannot understand God's ways" suggestion is an admission that there is no answer to the problem of suffering and evil. He is engaging in special pleading with a vengeance! Time and time again, he refers to the fact that scientists often say: "We just don't know." Now, if scientists can suspend judgment about things that they do not understand, and hold out faith that there *is* an answer, which may or may not become manifest sometime in the future, then why cannot theists do the same?

Rosenhouse also entertains the premise that no explanation or compensation could ever reconcile God with the magnitude of suffering and evil that exists. However, that is someone's *opinion*, and nothing more. What if, for example, one second in heaven erases 100 years of miserable life on earth? But don't expect atheists to be familiar with answers already in the Bible, e.g.: "For I consider that the sufferings of this present time are not worth comparing with the glory that is to be revealed to us" (Romans 8:18).

Compromising evangelicals repudiated

It is not only modern creationists who reject the "God worked through evolution" notion as inconsistent with God's character, if only because it would make God the Author of suffering and evil. Similar views were held by evolutionists such as Francisco Ayala (p. 151) and philosophers such as Bertrand Russell (p. 152).

Now consider the Bible itself. The author sagely quips:

"Suppose that science had discovered that the Earth was roughly ten thousand years old. Suppose further that the fossil record confirmed the creation of all animals, and that biologists found a variety of genetic codes in nature, distributed in a manner consistent with a reasonable notion of 'created kind'. Would anyone consider that an embarrassment for the Bible? Would anyone today be arguing that Genesis *obviously* was not meant to be taken literally or to instruct us in science? [emphasis in original]" (p. 164).

Rosenhouse adds the following: "If you want to redefine original sin, or summon forth strained interpretations of Genesis to reconcile evolution with Adam and Eve, then go right ahead. But please do not pretend that this represents some convergence of ancient wisdom with modern understandings. This is not science and religion in con-

version. This is science telling it like it is, and religion desperately trying to catch up" (p. 177).

A seeming openness to creationism

Unlike other ardent evolutionists, Rosenhouse generally avoids an automatically dismissive or automatically condescending attitude towards creationist contentions. He rejects the portrayal of creationists as yahoos or ignorant backwoodsmen.

Rosenhouse has a positive opinion of the quality of the Creation Museum in Kentucky:

"Have no illusions about the level of professionalism involved at the Creation Museum. This is not a fly-by-night operation or an amateurish set-up run out of someone's basement. You would never mistake it for the Smithsonian, but the exhibits look good and the environment is generally pleasant" (p. 137).

Here is how the author assesses the impetus behind creationism:

"My conclusions will not be to everyone's liking. In particular, I do not agree that evolution and Christianity can easily coexist. My claim is not that there is flat-out contradiction between the two, but simply that evolution provides enough to disquiet a traditional Christian that it is unsurprising that so many believe that they must choose one or the other. Moreover, it is a mistake in my view to think that anti-evolutionism is primarily about an idiosyncratic interpretation of the Bible clung to by a handful of extremists. Of far greater concern are the implications of evolution for human significance, the cruelty of the evolutionary process, and the demise of the traditional design argument. In my conversations with creationists, these are the points, far more than concerns about the age of the Earth or an understanding of

Genesis 1, that seem endlessly to recur" (p. xiii).

Rosenhouse claims to have initially found many creationist arguments persuasive. That was, he says, until he read the works of Philip Kitcher, Niles Eldredge, and Douglas Futuyma (p. 19). The informed reader may do a double-take, as I did, and question the credibility of Rosenhouse's overall reasoning, especially the credibility of his understanding of creationism. If Rosenhouse is a seeker and thinker, how could he be impressed by those authors from so long ago? Fact is, Kitcher, Eldredge, and Futuyma had written nothing more than superficial hatched-jobs on creationism, and had been soundly debunked long ago.⁷ Rosenhouse should know better.



Figure 1. The original partial skeleton of the australopithecine Lucy.

A few of the author's double standards

The author complains that creationist speakers often speak on matters that are outside of their expertise. Yet Rosenhouse has no problem dwelling on biology, philosophy, and Christian theology—all of which are decidedly removed from his area of expertise, which is mathematics.

Rosenhouse one-sidedly complains about creationists who had indicated that no amount of evidence could ever convince them that the Bible is wrong. How many evolutionists could never become convinced that evolution is wrong?

The author complains that many home schoolers and attendees of Bible colleges live an insular life in which they are never exposed to non-Christian points of view. This seems laughable in view of the ways that such Christians are taught evolution—often to a greater depth than the counterparts in a secular school. And the state education system is not the only way that children are indoctrinated into evolution; the media and entertainment industries also ram evolution down our throats. In addition, how many secularists, notably in media and academia, know absolutely nothing about biblical fundamentalists apart from the lurid mischaracterizations and stereotypes of them?

In fact, Rosenhouse finally admits this double standard: "Insularity is a two-way street. It is not for nothing that academics have a reputation for living in ivory towers" (p. 15).

A false equivalency on Darwinian racism

The author is quite indignant at suggestions that Darwinism was behind various social evils, notably racism. He tries to confuse the issue by citing some early 20th century American southerners who had objected to evolution because it seemed to favour the equality of blacks and whites.

Rosenhouse's false equivalence, of Christian racism and Darwinian racism, is just that. A fringe element should not be conflated with the mainstream. Mainstream Christianity has always accepted the fact that blacks are fully human—as evidenced, for example, by sending missionaries to them. This activity implied recognition of the fact that non-whites have souls, and that non-whites are capable of understanding morality and living according to this morality. Racist ideas were never found in the Bible; rather, existing racist ideas from society were read into the Bible, with Scripture-twisting not found in non-racist areas. Ironically, long-agers demand that Christians do the same thing in principle: read the current fad of uniformitarianism into Scripture.

On the other hand, racism had been no add-on to, or fringe element of, Darwinism. For the longest time, Darwinism *was* racism—scientific racism, but nevertheless racism. In fact, racism was part of the everyday vocabulary of mainstream Darwinists, whose ideas revolved around the presumed and self-evident innate inferiority of non-whites to whites. Finally, such attitudes permeated Darwinian thinking for decades after 1859.⁸

The australopithecine 'Lucy' and human evolution

Rosenhouse cites Senter,⁹ who compared 36 skeletal traits shared between modern humans (*Homo sapiens*), the australopithecine 'Lucy' (*Australopithecus afarensis*; AL-288-1) (figure 1) and the modern chimp (*Pan troglodytes*). Senter concluded that, of the 36 traits, 14 were like those in the chimp and the remaining 22 were like those in the human, and this proved that 'Lucy' was transitional between ape and human, and not simply an ape. Of the 22 human-like traits, 12 were related to bipedalism and 10 were not.

An obvious problem with Senter's study is that there is no way to verify the developmental independence of the morphological characters he 'atomized' into discrete traits. Hence, how many independent traits there are is not known, but most likely it is less than the 36 considered above. However, a more serious flaw with Senter's argument is that "it would be wrong to simply consider Lucy as half-ape, half-human, since she bears characteristics that are not present in apes or humans".¹⁰ As such, it makes much more sense to consider the australopithecines as unique types of primates. This would be consistent with the conclusion of evolutionist Charles Oxnard's extensive analysis of these creatures. According to Oxnard:

"In each case although initial studies suggest that the fossils are similar to humans, or at worst intermediate between humans and African apes, study of the complete evidence readily shows that the reality is otherwise. These fossils clearly differ more from humans and African apes, than do these two living groups from each other. The australopithecines are unique."¹¹

On a related subject, Senter repeats the argument that creationist disagreements about whether a given taxon is a human or ape proves the transitional state of these fossils. This is a *non sequitur*. It, first of all, assumes that all creationist studies are equally detailed and are therefore legitimately juxtaposed with each other. The argument also ignores the fact that evolutionists themselves disagree as to the extent and significance of the "humanness" of the fossils. Finally, disagreement on the fossils may show nothing more than the ambiguity that is inherent in the interpretation of paleo-anthropological evidence. If so, then this ambiguity *by itself* undermines the certitude of the premise that humans evolved from 'Lucy' or from any other extinct 'ape-man'.

Methodological naturalism and ID (Intelligent Design)

Rosenhouse defends methodological naturalism in science as something that stems from the fact that there is no evidence for the supernatural, and not because scientists have decided *a priori* that supernatural events do not exist or otherwise cannot be part of science. However, not surprisingly, he does not tell us what he, or scientists, would consider adequate evidence for the supernatural. Would any evidence be good enough?

The author repeats the argument that a scientist would not consider God a valid explanation for an event any more than a plumber would consider God an explanation for a clog in a pipe. His argument is based on at least two sets of fallacies.

One fallacy is theological, and related to the attributes of God. Pointedly, one of the main attributes of God is that of Creator. On the other hand, involvement in plumbing is not an attribute of God. Consequently, rejection of God in creation is a repudiation of an attribute of God, and therefore atheistic. On the other hand, rejection of God in plumbing is not a repudiation of any attribute of God, and is therefore not atheistic.

A second fallacy is scientific and related to both singularities (miracles) and normative (non-miraculous) events. Both can coexist, and the reality of one does not negate the reality of the other. Let us, for the sake of argument, stretch the definition of plumbing to include static water-bearing vessels. Consider the miracle of water changed to wine (John 2:9). It was a singularity. On the other hand, the everyday behaviour of water in containers and pipes is normative.

What does all this mean? The admission of the fact of Jesus Christ changing water into wine does not require the plumber to contemplate divine intervention in the clogging of a pipe. Conversely, the acceptance of

only a naturalistic explanation for a clogged pipe does not require the plumber to assume that water could never be changed into wine by divine fiat.

Irreducible complexity in living things

The author brings up the Krebs cycle, the vertebrate immune system, blood-clotting cascade, wings of birds, and bacterial flagellum. He brushes off contentions about their irreducible complexity, pointing to the (alleged) ability of evolution to transform pre-existing structures, and the ability of transitional structures to have dual functions.

This is a *non sequitur*. Even if evolution takes place, and does so by modification of pre-existing structures, it, by itself, tells us nothing about how irreducibly complex structures themselves supposedly came about. More fundamentally, the “modification of pre-existing structures” is a form of ‘evolspeak’—a rhetorical device that presupposes the factuality of evolution. For instance, one could note the similarities between the head of the sledge hammer and the head of the pickaxe, and argue that the pickaxe is an evolutionarily modified sledge hammer. What’s more, the evolutionist could speculate that the transitional tool survived the natural selection process because it served as both an adequate hammer and an adequate pickaxe. However, such reasoning would only be potentially valid if one first assumed that evolution of tools takes place, and that one tool can evolve into another tool.

The author brings up the arch as a mystery-solved example of irreducible complexity. The arch would fall down if you removed any part of it. But it was not always so. When the arch was being built, scaffolding was used to hold the parts in place, and when the arch was finished, the scaffolding was removed, only then introducing the irreducible complexity. By analogy,

evolutionists would have us believe that currently irreducibly complex structures were once not irreducibly complex. It sounds nice but it has no substantive evidence for it. In fact, Rosenhouse tacitly admits as much. He revealingly says: “By applying similar principles, biologists have uncovered plausible evolutionary scenarios for a variety of complex adaptations” (p. 127). Priceless! Rosenhouse would actually have us believe that “plausible evolutionary scenarios” are strong enough to overturn the fatal objection, to evolution, posed by irreducibly complex structures.

Elsewhere (p. 53), Rosenhouse defends evolutionary scenarios as starting points for research and not as ends in themselves. However, “starting points for research” are hardly synonymous with facts, much less solved problems. In fact, evolutionists, in their chronic discounting of the supernatural, always say that “extraordinary claims require extraordinary evidence”. Very well, then, let the same standards apply to them. So-called “starting points of research” are hardly synonymous with evidence, let alone extraordinary evidence.

Conclusions

The reader may, at first, think of this book as the work of someone who is searching for answers and attempting to fairly understand the creationist and ID movements. Such an attitude is encouraged by the author’s tone being quite free of stridency. In addition, it is clear that the author has spent much time with creationists in order to understand first hand how they think.

Upon close examination, however, Rosenhouse’s book turns out to be a typical anti-creationist one. The absolute factuality of evolution is treated as an axiom (actually, the mantra is of being supported by ‘overwhelming evidence’). Challenges to evolution are dismissed, belittled, or explained away, often in very superficial manner, and

the contentions of the evolutionists are accepted with little if any question.

References

1. WHO [World Health Organization] Concerned About Danish Kids’ Drinking Habits, *Jyllands-Posten*, 22 September 2011.
2. Jepsen, P. *et al.*, Alcoholic cirrhosis in Denmark, *BMC Gastroenterology* 8:3, 2008.
3. Spilde, L., Increased divorce rates are linked to the welfare state, *sciencenordic.com*, 18 Oct 2012
4. Booth, M., Dark lands: The truth behind the ‘Scandinavian miracle’, *theguardian.com*, 27 January 2014
5. Sanandaji, N., *Scandinavian Unexceptionalism: Culture, Markets and the Failure of Third-Way Socialism* (Readings in Political Economy), ebook, 2015.
6. Silberstein, B.K., Sorry leftist Americans, Your Swedish Utopia does not exist—it’s time to kill the myth about the superiority of the Nordic welfare state model, *weeklystandard.com*, 30 July 2015.
7. Gish, D.T., *Creation Scientists Answer Their Critics*, Institute for Creation Research, 1993.
8. Bergman, J., *The Darwin Effect*, Master Books, Green Forest, AR, 2014.
9. Senter, P., Were Australopithecines ape-human intermediates or just apes? *American Biology Teacher* 72(2):70–76, 2010.
10. Conroy, G.C., *Reconstructing Human Origins*, 2nd edn, W.W. Norton & Company, New York, p. 262, 2005.
11. Oxnard, C., *Fossils, Teeth and Sex: New Perspectives on Human Evolution*, Hong Kong University Press, Hong Kong, p. 227, 1987.

A northern Sodom?

**Discovering the City of Sodom:
The Fascinating, True Account
of the Discovery of the Old
Testament's Most Infamous City**

Steven Collins and Latayne C. Scott

New York, Howard Books, 2013

Murray R. Adamthwaite

After the Foreword and Preface this book falls into two main parts:

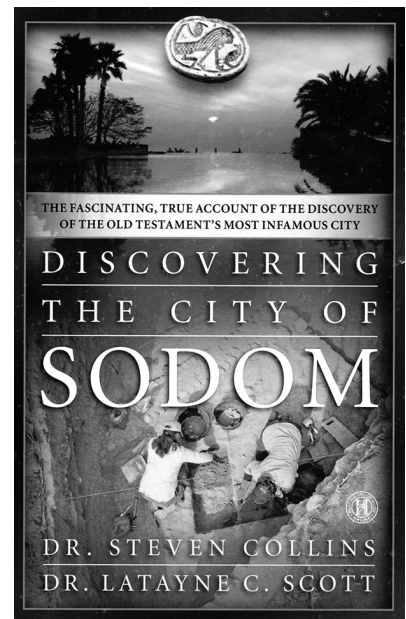
One: Land of Facts and Fables, wherein Collins and Scott trace the location of Sodom and the associated ‘cities of the plain’ (Hebrew *‘ār^{ey} hakkikkār*). They relocate these cities from the now-conventional site at Bab ed-Dhra and further south, in the Ghor region on the south-eastern side of the Dead Sea, to what they contend is the more traditional location on the ‘Plains of Moab’ at the north-eastern end of the Dead Sea, the modern site of Tall el-Hammam. The conventional identifications, proposed by William F. Albright, G. Ernest Wright, and others in the 20th century, are an innovation, unsustainable according to biblical and archaeological evidence. The ‘new’ site, the authors maintain, is the right location after all, and so they return to what medieval sources (e.g. the Madaba Map), and certain 19th century geographers, identified as Sodom, Gomorrah, Admah, and Zeboiim.

Two: the Science of Tall el-Hammam, wherein the authors explore the archaeology of this site from seven seasons of excavations, and then, being convinced of their identification, they examine the dating implications of their work for a 2nd millennium BC Old Testament chronology. It is on this latter point that difficulties arise, of which the authors are aware but press on nevertheless.

Location of Sodom

In regard to the location of the cities, Dr Collins does at first glance seem to be on to something, especially when he has intimate first-hand knowledge of the relevant sites (p. 112). Furthermore, the ancient testimony he cites is not to be lightly dismissed, as Albright and others have tended to do, or so he alleges. In this connection, Collins places much emphasis on line-of-sight geography, i.e. what can and can’t be seen from this or that location, a fair and reasonable procedure at first glance. In particular, he lays considerable stress on Genesis 13:10–12, according to which Lot could see “all the valley of the Jordan” from a point between Bethel and Ai, which can easily include the Kikkar region and Tall al-Hammam, but a Sodom at Bab ed-Dhra near the Lisan and a Gomorrah even further south are well out of visible range, no matter how good the atmospheric conditions. Hence the Ghor region of the Dead Sea is, for him, out of contention. However, as it turns out, Collins places rather too much weight on this point: there are other considerations here which point in favour of a Ghor location.

Although the authors carefully read the geographical data of Genesis 13, suspicions are immediately aroused when Collins informs us that the biblical Ai is to be identified with Et Tell (p. 112). Yet this identification, along with the related location of Bethel as the modern Beitin, has been seriously challenged in recent years.^{1,2} However, this point is not crucial, since Bethel and Ai were, of course, in the central hill country, the vantage point from which Lot surveyed the cities of the plain. Whatever the solution to the Ai problem, Collins and Scott lay too much weight on this ‘line-of-sight’ critique of the southern location, since a reading of the text of



Genesis 13 indicates that Abraham and Lot may well have moved from the Bethel-Ai region when Lot “lifted up his eyes and saw the whole valley of the Jordan”, which could well indicate that the *kikkar hayyarden* (“valley of the Jordan”) of Genesis 13:10 and the *kikkar biqat yeriho* (“valley of the plain of Jericho”) in Deuteronomy 34:3 are two different entities with two different locations, as Bryant Wood points out.³ Whatever, the text of Genesis 13 is not as definite in its geographical references as Collins and Scott would have us believe.

Are there alternative locations? Could Bab ed-Dhra be right after all? Collins’ identification is not new, even if he seems to have some new evidence in its support. However, he and Scott focus on Albright and Wright as the architects of the southern end hypothesis, but it is really the very thorough investigation of the Ghor region by Walter Rast and Thomas Schaub in 1973–1974 that established Sodom’s location in this area. Yet Collins and Scott appear largely to ignore the evidence and conclusions of Rast and Schaub.⁴ Their bibliography includes two articles by Rast: one an entry in the *Anchor Bible Dictionary*



Figure 1. Ruins on top of Tell al-Hammam, the site Collins and Scott designate as Sodom

(1993), and another an essay in the D.G. Rose festschrift of 1987. Schaub is listed in a joint essay with M.S. Chesson in the multi-author work edited by T.E. Levy *et al.*, *Crossing the Jordan: North American Contributions to the Archaeology of Jordan*, London, 2007, which seems to be all. Yet Rast and Schaub have published prolifically during the late 1980s and through the 1990s, in addition to the official site reports for the Jordanian Department of Antiquities. Virtually none of this material appears in Collins' and Scott's volume—a serious omission. By contrast, Bryant Wood lists an extensive bibliography of reports and articles by both Rast and Schaub in his survey and discussion of the evidence for Sodom and Gomorrah.⁵ Accordingly, Wood builds much of his case for Bab ed-Dhra and Numeira as Sodom and Gomorrah respectively on the investigations of Rast and Schaub, as well as a number of other investigators.

Willem van Hattem also discusses the issue of the cities of the plain and, unlike some critics who dismiss the story as 'products of the storyteller's art', he credits the account as historical.⁶ However, he too builds on the

investigations of Rast and Schaub, and while he insists that there is further work to be done on both the Eastern and Western Ghor, the Rast and Schaub explorations have solidly established both the historicity of the biblical story and also the location of the notorious cities.

Then there is Zoar, where Lot and his daughters fled (Genesis 19:18–22). This seems to be well to the south (cf. Genesis 19:19–20), indeed just south of the Zered tributary according to the Madaba Map.⁷ The town is mentioned together with Eglath-Shelishiyah in a broad sweep of Moabite territory from its northern border (Heshbon and Elealeh) to its southern region (Nimrim and Arabim) in Isaiah 15:4–7; likewise in Jeremiah 48:34–35. Arabim in particular is likely to be located near the border with Edom. Later, in the Middle Ages, Zoar was located near the Monastery of St Lot, and called Zugar, while today it is located near the modern town of es-Safi. Numeira, eight miles north of es-Safi, has linguistic connections with Gomorrah and could well preserve the ancient name '*Amorah*'. Then further on, Bab ed-Dhra lies 16 km north of Numeira.

It is the largest ancient ruin, and since it shows occupation in the Early Bronze period it would seem to be the biblical Sodom. While this was the suggestion of Albright and Wright, it received strong confirmation from Rast and Schaub in the mid-1970s.

Collins and Scott are non-committal on the location of Zoar, save to separate it from the other four 'cities of the plain', and place it somewhere to the south of these, although how far south they are not prepared to say. However, both Josephus and Eusebius place it at the southern end of the Dead Sea, and while the modern es-Safi may not be the precise place of Zoar, it must be fairly close, since there is an unbroken tradition from antiquity which places it in that vicinity. This being the case it is stretching things, to say the least, that in fleeing Sodom the Lot family travelled all the way from Tall al-Hammam on the Plains of Moab down to the southern end of the Dead Sea, a distance of more than 60 miles, and braving falling brimstone (and salt) for much of the way. This contradicts Genesis 19:17, where Lot is told, "Do not stay anywhere in the valley, but escape to the mountains", whereupon Lot pleads that he be allowed to flee to Zoar since it was "near" (v. 20). This information regarding Zoar puts Collins' and Scott's identification of Sodom into serious doubt.

Redating Abraham

On the basis of his relocation of the 'cities of the plain'—Sodom in particular—and the fact that no Middle Bronze III or Late Bronze artefacts have been found at Tell al-Hammam, Collins concludes that their destruction occurred abruptly late in the Middle Bronze II period (around 1700 BC, on conventional chronology), much later than conventional chronology allows. However, this involves redating Abraham, which is a tall order. He fits well with the Third Dynasty of Ur (i.e. Ur

III, from 2112 to 2004, according to Kuhrt⁸), wherein his father Terah and family “served other gods” in Mesopotamia (Joshua 24:2), but not to a later period. Moreover, a wholesale redating of the 2nd millennium BC on—ultimately—the strength of one site is a long stretch, but pursuant to this Collins and Scott do not hesitate to turn the whole dating procedure on its head. Thus they proceed to redate Joseph, the Exodus, and the Conquest according to the standard ‘late date’ model of a Hyksos-period Joseph and a Ramesside Exodus (1260 BC, approx.), and at the same time dating Abraham to around 1700 BC. This is too much for some reviewers to swallow, and likewise for myself.

Two considerations *inter alia* point clearly to an early date Abraham:

‘Ur of the Chaldeans’ (*Ur Kašdim*, Genesis 11:31) can only be the Sumerian Ur of Lower Mesopotamia. The epithet ‘of the Chaldees’ is admittedly anachronistic, but is at the same time intended as explanatory for the time the Old Testament received its final form in the time of Ezra (this is not, of course, to countenance the JEDP theory of documentary critics). In Neo-Babylonian times the Kaldu (Heb. *Kašdim*) were a tribe from Lower Mesopotamia (from which came the Chaldean dynasty of Nebuchadnezzar), while Ur itself enjoyed something of a revival as a religious centre at the same time. The excavations of Sir Leonard Woolley in the 1920s revealed just how extensive Ur was in Sumerian times (late 3rd millennium BC), but just as surely Ur was *not* prominent after the collapse of Ur III around 2000 BC. The subsequent chaos of the Isin–Larsa period ensured Ur’s eclipse. While it remained a cult centre for the worship of the moon deity Nanna, it was never again any sort of prominent commercial or residential centre.

Some scholars have indeed argued for a northern ‘Ur’ (Cyrus Gordon *et al.*), but their reasoning has met with

little acceptance. Therefore, if we adopt the Sumerian Ur this places Abraham in the Ur III period (see below) when Ur was at the height of its culture and political power. Archaeologically—on the old configuration—this is the Early Bronze III/IV, into Middle Bronze I (2350–2000 BC), and while the dating for the destruction of Bab ed-Dhra and Numeira is, according to Rast and Schaub, the end of Early Bronze III, Collins regards it as a ‘fudge’ to bring that destruction into the ‘Intermediate Bronze’ (the new configuration).⁹

But why should these archaeological periods with their associated dates be regarded as some kind of ‘holy writ’? This has long troubled me. On a reading of the chrono-genealogies of Genesis 5 and 11, the Flood happened around 2500 BC, which means these archaeological periods are grossly inflated, to say the least, and while a major discussion of this issue is outside the scope of this review, such a major revision is nevertheless urgently necessary from a creationist standpoint.

A date of c. 930 for the Disruption of the Kingdom, along with a straightforward reading of the chronological information given in the Old Testament narratives (1 Kings 6:1; Judges 11:26; Exodus 12:40, and the patriarchal ages) yields a date of c. 2060 for Abraham’s call from Ur. Collins and Scott reject this date and appeal to the Septuagint (LXX) reading of Exodus 12:40: “the children of Israel sojourned in the land of Egypt and in the land of Canaan for 430 years” (pp. 134–135). This halves the actual time of the sojourn in Egypt, viz. 215 years. Meanwhile, the traditional Masoretic Hebrew text reads 430 years for the entire Egyptian sojourn. However, one of the Dead Sea Scroll manuscripts of Exodus, 4Q22 paleoExodus, is written in the ‘Old Hebrew’, pre-Exilic script, indicating a copy of a very early text,¹⁰ and although fragmentary it preserves Exodus 12:40, and the reading agrees with the Masoretic text. While this

is not necessarily decisive in itself, it does give quite powerful support to the traditional text. It should be noted here that the Qumran caves have yielded manuscripts whose text appears to support the LXX in places (notably in 1 Samuel), while the 430 years of Galatians 3:17 does seem also to derive from LXX. That said, however, we depart from the traditional Hebrew text only if there is compelling evidence pointing in that direction, and the evidence of Qumran Paleo-Exodus points to the traditional Hebrew text.

Conclusion

If the identification of Tell al-Hammam with Sodom entails a (very) late-date Abraham, and *inter alia* for the reasons above we reject that dating implication, we must find an alternative identification for this site. If David Rohl is in any way correct with his late 13th Dynasty Exodus theory,¹¹ a suggestion I find very attractive, I would suggest that the Transjordan campaign towards the end of the wilderness wanderings, as described in Numbers 21:21–30 and Deuteronomy 2:32–36, may provide a possible answer. While the Israelites did not normally burn the cities in which they were going to live (cf. Joshua 11:13; 24:13), they may well have burned the city on the mound of Tell al-Hammam, while it has gone unrecorded. The ‘ball park’ archaeological date for this would align with the Rohl thesis. Whatever, the site is not Sodom.

References

1. Livingston, D., Location of Bethel and Ai Reconsidered, *Westminster Theological J.* XXXIII:20–44, 1970.
2. Despite detractors, Livingston, ref. 1, began a wholesale reinvestigation of the location of Bethel and Ai, such that even Steven Collins himself agrees that Wood has now correctly reidentified Ai with Khirbet el-Maqatir. See also Collins, S., A response to Bryant G. Wood’s critique of Collins’ Northern Sodom Theory, *Biblical Research Bulletin* VII(7):2, n. 5, 2007.
3. Wood, B.G., Locating Sodom: a critique of the northern proposal, *Bible and Spade* 20(3):80, 2007.

4. Rast, W.F. and Schaub, R.T., Survey of the southeastern plain of the Dead Sea, *Annual of the Department of Antiquities of Jordan* (Hashemite Kingdom of Jordan: Department of Antiquities) 19:5–54; 175–185, 1974.
5. Wood, B.G., The discovery of the sin cities of Sodom and Gomorrah, *Bible and Spade* 12(3): 67–80, 1999. See also Wood, ref. 3, pp.78–84. Note the extensive body of literature by Rast and Schaub cited in each of these articles. Collins' reason for this omission becomes clear in Collins, ref. 2, p. 35, where he declares that Schaub's investigations do not support a Bab ed-Dhra location for Sodom, although Wood assumes that they do.
6. van Hattum, W.C., Once again: Sodom and Gomorrah, *Biblical Archaeologist* 44(2):87–92, 1981.
7. Note here the observations of Wood, ref. 3, pp. 78–79, on the location of Zoar. Significantly, Collins and Scott do not discuss Zoar to any great extent in their book, yet its location is pivotal to any discussion concerning Sodom. A survey of his discussion of the “biblical facts leading to the location of Zoar” in Collins, ref. 2, p. 11, significantly fails to mention Isaiah 15:5 and Jeremiah 48:34.
8. Kuhrt, A., *The Ancient Near East c. 3000–300 BC*, vol. I, Routledge, London, p. 56, 1995.
9. Collins, ref. 2, p. 27.
10. For a discussion, see Phillips, D.L., Hebrew-English Paleo Exodus—Scripture at the End of the Iron II Period, mellenpress.com, accessed 20 August 2015. I consulted a facsimile of the manuscript 4Q22 at the Australian Institute of Archaeology, Collins St, Melbourne (where it was housed at the time).
11. Rohl, D.M., *A Test of Time: The Bible—from Myth to History*, ch. 13, Century Random House, London, 1995.

Developmental genetics supports creation theory

**Homology, Genes, and
Evolutionary Innovation**

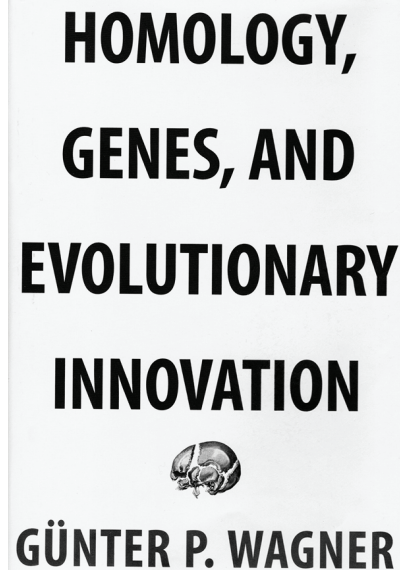
Günter P. Wagner

Princeton University Press, Princeton, NJ,
2014

Walter ReMine

This book focuses on the intersection of genetics and embryology—called developmental genetics—which seeks to understand how DNA strings are converted into functioning organs and body plans. Our understanding of this breathtakingly complex phenomenon is still exceedingly rudimentary, though modern techniques have finally opened up research. A typical technique maps out where and when, in the embryo, a particular gene is expressed. Another technique suppresses (or ‘knocks out’) a particular gene and then observes which embryonic characters do, and do not, develop. Most of Wagner’s book (~70%) is material of this type, and can be fully embraced by anyone (evolutionist or creationist). Offhand, I see no reason to doubt that material. However, it is quite technical—a slow, tedious read—and not recommended for the pedestrian. As a typical example:

“At stage 40, the pectoral fin buds show classical early colinear *HoxD* gene expression. *HoxD13* is expressed at the posterior margin of the fin bud nested within a slightly more extensive *HoxD12* expression domain, which itself is nested in a *HoxD11* expression domain that extends even further anteriorly” (p. 350).



There are creationist scholars for whom such material is fine dining.

This is an evolutionist book, but it never proclaims new evidence against creation or for macro-evolution. The book never engages the creation-evolution debate. There is an unspoken reason for that: evolutionists are bewildered by the new data and how to explain it. They are now vying to amend evolutionary theory to accommodate this new data. This book begins that process.

“Evo-devo”¹ is the nickname for this field that attempts to explain developmental genetics via evolutionary theory. Toward this explanatory goal, Wagner proposes new concepts and terminologies as a possible basis for further research. (That material comprises the other 30% of the book, which is a bit more accessible to non-specialist readers.) I will comment on that material.

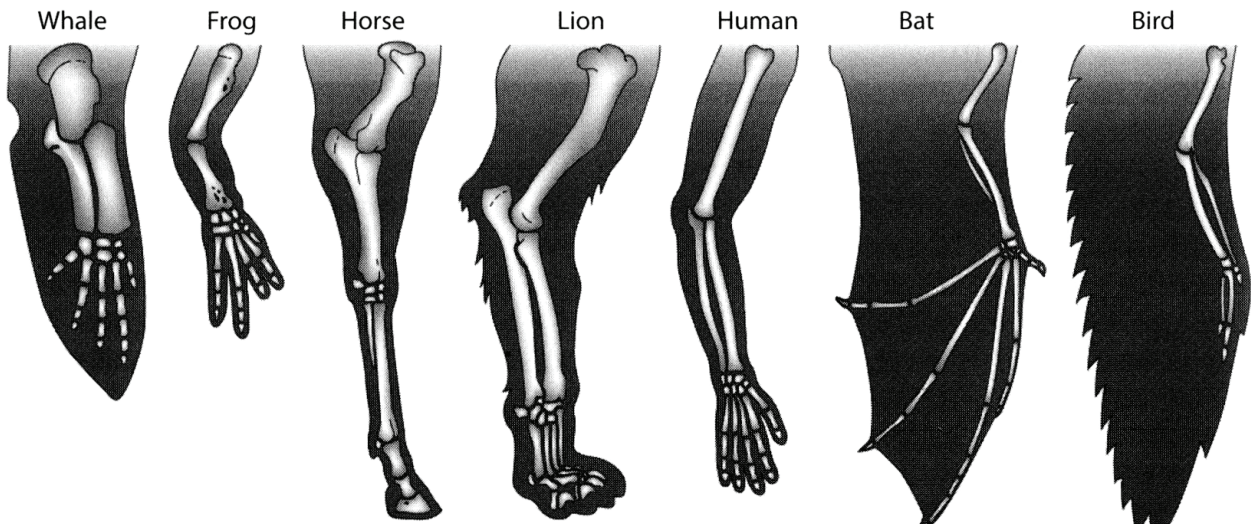


Figure 1. Wagner's 'textbook example of homology' (p. 24)

Homology and body plans

The book focuses on the evolutionary concept of homology. Unfortunately, homology is almost always defined by how it is *explained*, not by how it is observed. For example, Wikipedia defines homology as “the existence of shared ancestry between a pair of structures, or genes, in different species”. Traditional examples are the hands, paws, hooves, wings, and fins of mammals, which evolutionists say are ‘homologous’, or due to shared ancestry (see also figure 1).

The book ties three concepts together: (1) there exists a set of genes; (2) these are essential in the development of innovative body plans; and (3) evolutionists *believe* these are inherited from some common ancestor (i.e. these are a homology). In short, *Homology, genes, and evolutionary innovation* is an apt title for the book.

The evolutionary origin of novel body plans has always been controversial, especially these days due to Stephen Meyer’s excellent book, *Darwin’s Doubt* (2013),² about the sudden appearance of very disparate body plans during the Cambrian Explosion of fossil life-forms. Wagner acknowledges that the origin of novel characters and novel body plans “is one of the most important but least

researched questions in evolutionary biology” (p. 3). The fossil record and Cambrian Explosion show only the form and shape of organs and body plans (this is called morphology). Wagner acknowledges these are “one of the most difficult classes of homology relationships to explain” (p. 1).

Though homology is said to be a major evidence for evolution, the concept itself is problematic. Wagner notes: “There is no consensus, nor even a narrow consensus on the subject of homology and its mechanistic foundations. ... Every biologist will agree that homology is a confused and confusing subject” (p. xii). “No lasting progress can be made in explaining body plan evolution without a thorough housecleaning. The problem is that *many contradictory positions* on homology *made sense within* the research programs in which they were introduced [emphasis added]” (p. 5). So Wagner aims to update the homology concept, to make it suitable specifically for evo-devo research.

Major problems

The book indicates various problems facing evo-devo. For example: “It is now well established and common place that all animals

share a set of conserved genes that are causally important for the development of body plan characters. This was a *deeply surprising discovery* because, in the tradition of neo-Darwinian evolutionary biology, the possibility of homologous genes among distantly related species was explicitly dismissed [emphasis added]” (p. 26).

Wagner does a poor job revealing that fundamental problem. So, I clarify it here. Many of the important body plan genes are widely shared among disparate animal phyla. To evolutionists, that means these genes must have existed within some ancient common ancestor of all these groups. But these body plans are quite different from each other, as different as vertebrates, starfish, jellyfish, and insects. Therefore the common ancestor must have existed *much earlier* than the first appearance of these groups—much earlier than the Cambrian Explosion. In other words, these *widely important body plan genes* must have originated back at a time when there were microorganisms and *relatively little else with a body*. How could genes originating in microorganisms or proto-jellyfish, say, be essential in widely diverse body plans today? It is awkward to claim natural selection *originally* created these genes to control diverse

body plans: (1) because that common ancestor (whatever it was) didn't have much of a body; (2) because natural selection cannot create something for a *future* use; and (3) it is unlikely these genes, at their original inception, *just happened* to be well-suited to a future use for creating such diverse body plans.

This problem is causing a revolution in evolutionary thinking. Many evolutionary specialists now assert that natural selection is *not sufficient*, and some additional explanations are needed.^{3,4}

Wagner likewise thinks natural selection is not sufficient.⁵ He emphasizes an additional explanation, called structuralism.⁶ Structuralism focuses on form (or structure), and says this places *constraints* on the types of change that can occur. Thus, evolution is *constrained* by the structure of an organism, and this limits the direction evolution can go. Some characters are kept, not because of their function, but because they are built into the structure of the organism. In a sense, evolution is 'stuck' with them.

That conflicts with the selectionist explanation, which argues that a given character was kept, or lost, because of its effect on function. It also conflicts with the neutralist explanation, which argues that a given character was kept, or lost, precisely because it has *no effect* on function. All styles of explanation—structuralist, selectionist, neutralist, and much more—are part of the evolutionist's vast, structureless, theoretical smorgasbord—where each entrée is chosen, or omitted, based on the evolutionist's needs of the moment.

A second problem further surprised evolutionists: homologous characters are often not due to homologous genes.

"What is problematic, though, is the fact that clearly homologous characters can derive from different developmental mechanisms in different species" (p. 37).

"There is mounting evidence that homologous characters from distantly related organisms, like

grasshoppers and fruit flies, *often use quite different genes for the development of clearly homologous characters*, like insect body segments. Hence, *the identity of morphological characters cannot be explained by the identity of the set of genes that directs their development* [emphasis added]" (p. 2).

"... *the most challenging problem* when attempting to explain character identity; namely, *unquestionable homologies* (i.e. character identities across species) are often associated with *extensive variations in developmental pathways and mechanisms* that produce these characters [emphasis added]" (p. 6). "There is a growing body of evidence ... that shows that seemingly the same character can be realized by different genes in different species" (p. 74).

"Continuity of morphological characters is not subscribed by continuity of genetic information. This seems a *pretty depressing situation* ... and motivates the notion that homology may be an illusion ... [emphasis added]" (p. 90).

"... developmental pathways of homologous characters can vary considerably between species without affecting the identity of the characters concerned" (p. 412).

"... similarity of a gene regulatory network of some tissues, even one in which multiple genes are involved per se, is not strong evidence for homology" (p. 113).

In short, there is considerable independence, or disconnect, between morphology and its underlying genes—they are not homologous together. This throws a monkey wrench into the homology concept. Will the real homology please stand up: is it morphology, or is it genes, that determine homology?

It gets worse. As the embryo develops, fundamentally disparate cell types emerge, multiply, and eventually form distinctive body organs.

Traditionally, evolutionists viewed these distinctive cell types⁷ as an important clue about the homology of the organs they produce. Wagner indicates this view has been countered by modern evidence. Wagner writes there are,

"... a number of examples for which clearly homologous characters derived from *different* cell populations during embryogenesis or followed *different* developmental pathways to arrive at the same adult morphology. One possible reaction to this fact is to assert that homology is a meaningless concept [emphasis added]" (p. 90).

Nonetheless, he pursues a "second option—namely, to assume, for example, that embryological origins are *irrelevant* for the developmental basis of homology ... [emphasis added]" (p. 90).

So for Wagner, genes are not reliable, and embryological origins are not relevant, as indicators of homology. He therefore introduces a new concept involving 'networks' of genetic material. His concept, called a Character Identity Network or ChIN,⁸ serves as a possible source of homology, since none of the other things is a reliable source. The concept is as yet nebulous and unclear. Its purpose, it seems, is to encourage 'research', and to enable the spinning of new explanations.

Homology vs convergence

Homology has long been held as a major evidence in favour of evolution. Unfortunately, evolutionists typically define it in terms of *explanation*, not in terms of observation. That raises the question: how can we observe homology? Without a clear way to do that, evolutionists are precariously close to saying: "The shared similarities between mammalian hands, paws, hooves, wings, and fins are a homology, *because we evolutionists say it's a homology*—and homology, by definition, is due to shared ancestry.

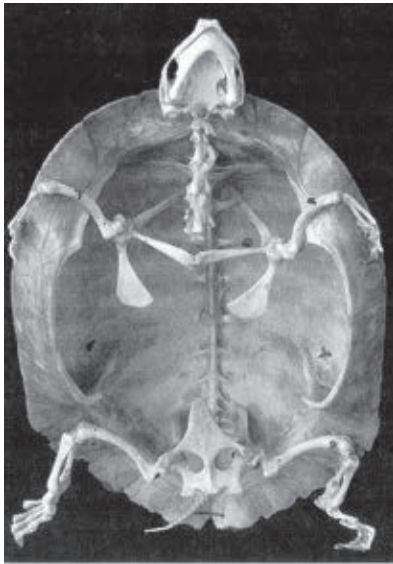


Figure 2. A turtle fossil from Wagner's book. Wagner writes: "This is the problem for the Darwinian way of thinking: what evolutionary sequence can explain the origin of the turtle body plan in a series of small steps when the scapula can be only either outside or inside of the rib cage? What would the intermediate steps be? Matters are not helped by the fact that the fossil record does not reveal any intermediate morphologies. Turtles seem to be the ultimate hopeful monsters—a sudden, radical deviation from the ancestral body plan without any plausible or documented intermediate forms. What further confounds the situation is that even their phylogenetic affiliation with fossil forms is difficult to assign" (p 180).

So, evolution is a fact!" We need a way to cut through any such argument by bald assertion or circular reasoning. In particular, how do we observe or identify a homology? Can that be done objectively, without relying on evolutionists' say so?

Here is the deeper problem. When two species share a similar character, then it might perhaps be explainable by common descent (i.e. a homology), but oftentimes it is *unexplainable by common descent*. Evolutionists call these latter characters 'convergences' or 'homoplasies', and these are abundant in nature—at the morphological, embryological, and molecular levels.⁹ An example is your eye and the octopus eye—which are remarkably similar,

each containing a lens, iris, retina, an optic nerve, and muscles for rotating the eye and controlling the iris—yet these similarities cannot be explained by common descent.

Evolutionists partition similar characters into two types: those that can be explained by common descent versus those that cannot. Typically, evolutionists silently set aside the latter group, omitting it from discussion as though it were irrelevant. Wagner does that. He attempts to clarify the concept of homology as a central focus of his book, yet remarkably he scarcely mentions convergence. That omission dooms any attempt at clarification.

Presentations aimed at convincing the general public that evolution is a 'fact' drastically downplay convergence, or omit it altogether. This approach—of brushing convergence aside—is used when evolutionists are *trying to convince you* that 'all is well in the house of evolution'. Wagner is in that mode when wading through the new data from developmental genetics—which is bewildering evolutionists. For Wagner's purposes, the topic of convergence would be an annoyance. Also, it would confound his attempt to clarify the homology concept. So he silently omitted it.

All evidence favours evolution?

Contrast that with the 2004 book, *Life's Solution: Inevitable Humans in a Lonely Universe*, where Simon Conway Morris *first* takes evolution as an undeniable fact, and *then* focuses exclusively on convergence, citing many striking examples of it. For example, according to evolutionists, the origin of sight occurred over 40 separate times (such as the compound eye of the fly), and the origin of a lens-bearing eye occurred at least seven separate times, as it occurs in vertebrates, cephalopods (e.g. octopus), jellyfish, a spider, annelid worms, and crustaceans. Morris then uses convergence (and its abundance) as *evidence*

for the power of natural selection. He therefore concludes: if life exists elsewhere in the universe, then (by convergence) it will almost surely be much like life on earth, and will likely include large-brained, bilateral, upright hominids much like ourselves. His book is packed with evidence against evolution, yet he takes evolution as an undeniable fact.¹⁰

Here is why. In the evolutionist's way of thinking, there can be no evidence against evolution. Instead, all evidence *against* evolution is reinterpreted as evidence *in favour* of some evolutionary explanation—no matter how far-fetched, no matter the paucity of experimental demonstration, and no matter how untestable—because evolution is a 'fact'! For example, there exist similar characters that cannot be explained by common descent,¹¹ and these are abundant in nature—which makes this remarkable evidence against evolution. Instead, evolutionists interpret all that as evidence *in favour* of the 'incredible power of natural selection'. This same faulty thinking occurs many more times: on the large morphological gaps in the fossil record (i.e. lack of gradualism over large scales); on the systematic absence of clear-cut ancestors and lineages; on the bacterial flagellum; on the biomolecular pattern they call 'concerted evolution'; and on the origin of life, to name a few. This type of thinking skews the evolutionist's wording everywhere. Raw, speculative evolutionary explanations are given as 'plausible', 'believable', 'satisfactory', or 'fact'. Virtually all evolutionist books, including Wagner's, fit this mould of thinking. This is reflected in the evolutionist's often repeated slogan: 'Evolution is a fact; we evolutionists are just uncertain *how* it occurred.'

Objective homology

Evolutionists need some objective method for *observing* and distinguishing homology from convergence.

One suggestion, often employed, is to use cladistics. Cladistics classifies species into a nested hierarchical pattern, called a cladogram. This is like the classification of library books, where some books are science books, *of which some* are physics books, *of which some* are nuclear physics books, and so forth, in a nested pattern of subsets, within subsets, within subsets—like nested Chinese boxes. In particular, cladistics *seeks to create* a classification that maximizes the number of nested characters, and minimizes the number of non-nested characters. This method (known as pattern cladistics or transformed cladistics) is scientifically neutral (and usable by anyone, creationist or evolutionist) and doesn't allow evolutionary storytelling to distort the results. Explaining the results comes later.

After the best cladogram is identified, evolutionists *explain* the non-nested characters as 'convergences' and the nested characters as 'homologies'. In short, cladistics robotically minimizes the number of 'convergences' and maximizes the number of 'homologies'.

However, pattern cladistics doesn't work well for evolutionists. So they created a version called evolutionary cladistics (or misleadingly, 'phylogenetic cladistics'¹²), which allows evolutionary storytelling to affect the results. Evolutionists can change the results by using a loss explanation, where they claim a given character was lost in some organisms and kept in others. Some evolutionists (including Wagner) also claim a character can be *re-evolved* after it was lost. These speculative scenarios can alter the topology of the cladogram, *thereby altering the identification of convergences and homologies*.¹³ In other words, by using evolutionary storytelling, evolutionists have some latitude to reclassify convergences and homologies in various ways—depending on their needs at the time. They have some flexibility.

Nonetheless, it's still not enough flexibility for Wagner's purposes, so he rejects any strict reliance on cladistics and regards it as incompatible with his research program.¹⁴ He is left with no independent means to identify homology. Instead, cladistic findings are viewed as merely suggestive: they are embraced or brushed aside, depending on the needs of evo-devo storytelling.

Wagner's solution is to define homology vaguely, in effect allowing evo-devo researchers to redefine it case-by-case. He says: "[W]e shall strive to fill in with biological detail what we mean when we say two characters are the same [emphasis in original]" (pp. 244–245). In other words, two characters may be 'the same' (and therefore homologous) based on morphology, or genes, or embryological cell-type, or ChINs, or whatever else the researcher chooses to grasp as a 'biological detail'. The concept is wide open. Wagner insists: "*it may not do any harm to abandon the quest for definitions of homology [emphasis in original]*" (p. 244).

Wagner wants to press onward with evo-devo research. He therefore thinks it better to have vaguely defined terms than no terms at all.

The separate-vs-shared problem

Other problems are encountered when attempting evolutionary explanations of specific body plans. Here are some commonplace issues: (1) Natural selection cannot improve a character unless its genetics are *exposed* to selection—or 'individualized'¹⁵—and that requires the genetics for that character to be *separate* and distinct from other things. On the other hand, (2) evolutionists often want improvements to be *shared* by many places in the body—so improvements in a design (say to fin, feather, limb, muscle, tendon, or eye) would occur to *all* instances of these in the body—and this would require some means of

sharing the same genetic instructions among all (and only) instances of that design. But those are two contradictory requirements—*separate* genetic instructions versus *shared* genetic instructions. *You cannot have them both at the same time*. Therefore, evolutionists need some means of switching back-and-forth, as needed in their storytelling. Also, the *genetic reorganizations* (both in the sharing and the separating directions) need to be *accurately targeted* to avoid disrupting the rest of the genome.

For example, suppose you want to explain the evolutionary origin of fish fins. You might suggest, say, that natural selection first created genetic instructions for a crude fin, eventually followed by a genetic instruction to "do it four times" (with bilateral symmetry), to make two crude front fins and two crude hind fins. At that point, it is not possible to specialize some fins separately from others, because "do it four times" does not expose the fins separately to selection. To allow specialization of front fins differently from hind fins, the fin genetics must first be *reorganized* to allow them to have separate genetics—so they can be separately selected. Such genetic reorganization is not, in itself, adaptive because it has no immediate benefit. And since natural selection cannot select for some future use, the genetic reorganization must occur without significant guidance from natural selection. Moreover, once that is done, one cannot explain *shared* changes to all four fins because they now have separate genetics.

A similar problem occurs for feathers, where a *shared* feather design is used all over the body, yet each feather is *specialized* for a purpose (e.g. flight feathers for flight versus downy feathers for warmth) and for length and colour.

In this way, one evolutionary explanation can make further evolutionary explanations awkward or implausible. When placed end-to-end, over the long haul, evolutionary explanations get

tripped up by their own feet, as they get entangled in their contradictory requirements. This type of problem occurs frequently in evo-devo.

Evo-devo explanations need accurately targeted genetic reorganization, back and forth between *separate* genetics versus *shared* genetics. The origin of finely designed fish fins—plus their further transformation into mammalian hands, paws, hooves, wings, and fins—would require it. Your hands are highly specialized *separately* from your feet, yet your hands and feet *share* the fact that each has five digits—quite unlike fish fins. Likewise for the wings and feet of bats. Likewise for the fins of whales. And so forth. Targeted genetic reorganization, of the proper sort, would be required many, many times,¹⁶ periodically interleaved with natural selection, of the proper sort.¹⁷ Are we to believe nature dances to the fancy tune plucked by evo-devo storytellers?

One-to-one correspondence

To explain the fate of a character, evolutionists typically assume it is controlled *cleanly by one gene*—that is, the gene has *only one effect* and no side effects. Therefore, any selective effect on the character (be it advantageous or disadvantageous) will directly apply likewise to the gene. Under that assumption, the fate of the character, and the fate of the gene, are substantially tied together, one-to-one.¹⁸ This made evolutionary storytelling seem vastly more plausible, and so it was used for decades in technical evolutionary genetics textbooks, in computer simulations, and especially in presentations aimed at an unwary general public.

That assumption is not plausible. It is now known that most genes affect *more than one* character—this is called *pleiotropy*. Think of it as side effects. Studies now show that, on average, each gene affects 7+ different characters, with some genes affecting

as many as 35 different characters. How can macro-evolution occur, when gene side effects are *interlocking* in so many different ways? This makes macro-evolution vastly more awkward to justify, which is why evolutionary apologists still avoid the issue and tend to omit it.¹⁹

A similar conceptual avoidance occurs in Wagner's book, where he assumes away these types of problems. He uses a variety of terms for special groupings of genes,²⁰ so I here simply call them 'gene networks'. At key points in his explanations, he needs his gene networks to have only *one* effect on development²¹—so they do not have multiple diverse (undesirable) effects on development—and therefore his gene networks are *cleanly exposed* to natural selection (at least, when he wants them to be). He assumes away the possibility that his gene networks have multiple undesirable side effects that are out of control of the evolutionary storyteller. His assumption is silent and implicit, accomplished by omitting any serious discussion of the problem.

Now combine these issues together: (1) development is controlled by networks of genes; (2) where each gene (and additionally, the 'emergent properties' of the evolving gene network) typically has *many side effects*; and (3) evolutionary storytelling *requires* frequent genetic reorganizations—which suddenly exposes these many various side effects *to a different genetic context*. Notice those three are *random* with respect to each other.²² Other than wishful thinking, are there any testable scientific grounds to believe this process isn't overwhelmingly harmful?

Concerning creation

Though Wagner did not intend it, his material is exceedingly encouraging to creationists, and to Message Theory in particular. I discuss this next.

Message Theory claims life-forms were reasonably designed to accomplish three goals simultaneously. The biological designs are: (1) for survival; (2) to look like the product of *one* designer (rather than the product of multiple designers acting independently); and also (3) to resist macro-evolutionary explanations (all of them, not just Darwin's). Wagner's material confirms 2 and 3 (and does not dispute 1).

For example, the existence of *shared genes*—essential to the body plans of diverse animals—helps unify life-forms as the product of one designer, while those same genes are a radical problem for macro-evolution. All three design goals (1, 2, and 3) are accomplished simultaneously. That fits Message Theory well.

Or, take the other data: homologous structures are often not caused by homologous genes nor by homologous embryology. The similar structures shared between species indicates they had the *same* designer. But they are often caused by *different* genes and *different* embryological pathways, which *resists* macro-evolutionary explanations. All three design goals (1, 2, and 3) are accomplished simultaneously. That fits Message Theory well.

This pattern of data turns evo-devo explanations into mincemeat gobbledygook. Evo-devo explanations of homology are revealed as incoherent, structureless storytelling—where the basis for identifying and explaining 'homology' is contradicted from one case to the next. This is in accordance with design goal 3: life was designed (in part) to resist macro-evolutionary explanations.

Lastly, take Wagner's re-emphasis on structuralist explanations—the idea that form and structure of an organism *constrains* (or limits) its evolution. Though Wagner did not intend to, he has stepped closer to the creationist position. As a consequence of design goal 3, Message Theory predicts²³ life-forms were designed with *limits* to biological change.²⁴ In other words,

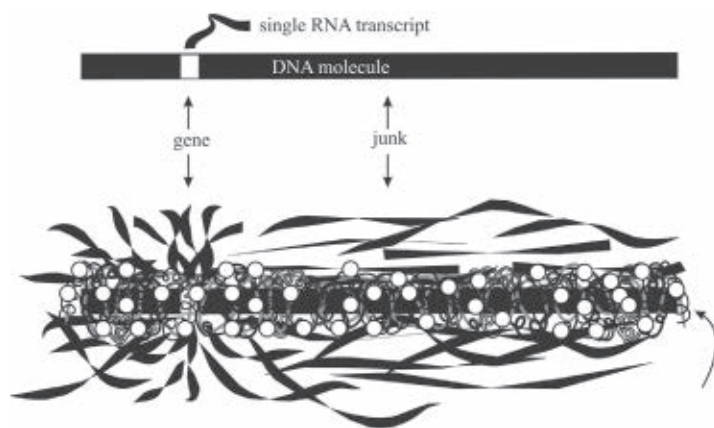


Figure 3. A general way to limit biological change is to use the same DNA sequence—the same gene—in various different ways (from Williams²⁷).

Message Theory predicts structuralism and *lots* of it!²⁵

A general way to limit biological change is to use the *same* DNA sequence—the same gene—in various *different* ways. This complex ‘matrix’ or *mosaic of interlocking* genes means large changes would be eliminated due to their adverse effects on survival. One example is genes that have multiple side effects (i.e. pleiotropy, discussed above). Another example is to have multiple genes *overlap each other* (in various possible ways) on the *same strand* or on *opposite strands* of the DNA double helix—these phenomena are already known to be common (figure 3). Another example is that, “there is increasing evidence that the gene regulatory network state of a cell is governed not by one core network, but by a *mosaic of densely interconnected* network modules [emphasis added]” (p. 423). A further example, predicted by Message Theory, is to have many key genes *used for both* body and sperm, and likewise many key genes *used for both* body and egg.²⁶ Again, the *same* DNA, used in *different* ways. Structures such as these help limit changes to those genes. More structuralism is expected to be discovered.

Creationists should not be scared by the material in Wagner’s book. On the contrary, they should be encouraged by it.

References

1. The alternative word order, ‘devo-evo’, is also used.
2. See review: Woodmorappe, J., Darwin’s dirty fossil secret, *J. Creation* 28(1):45–49, 2014; creation.com/images/pdfs/tj/j28_1/j28_1_45-49.pdf.
3. See Mazur, S., *The Altenberg 16: An Exposé of the Evolution Industry*, North Atlantic Books, Berkeley, CA, 2010.
4. ReMine, W.R., Desperate attempts to discover ‘the elusive process of evolution’ (review of *The Altenberg 16*), *J. Creation* 26(1):24–30, 2012.
5. Wagner is quite vague (almost non-existent) about his description of the problem, and his rejection of the purely selectionist solutions to it. He scarcely discusses these things. That is mysterious because that is a central driver of his book, so why would he be vague about it? Perhaps it is due to the evolutionist’s habit of *avoiding* statements that would aid and abet the creationists.
6. Wagner also revives the concept of typology, which was soundly rejected throughout most of the 20th century, most notably by Ernst Mayr.
7. Even at the level of cells, cell homology is ‘decoupled’ (or disconnected) from cell function and cell phenotype (p. 270).
8. Wagner allows ChINs to become masked, and later unmasked, to produce genetic throwbacks or ‘atavisms’ (p. 418).
9. The abundance of the pattern called ‘convergence’ is a prediction of Message Theory, because it precisely meets the three design goals given by Message Theory.
10. See review: ReMine, W.R., Evidence for Message Theory, *J. Creation* 20(2):29–35, 2006.
11. More precisely, there exist shared similarities that cannot be explained by common descent, nor by atavism, nor by lateral DNA transfer—so evolutionists call these ‘convergences’.
12. Cladistics never identifies real ancestors. (Where ‘real’ means you can hold their fossils in your hands.)
13. Such storytelling is used so often it threatens to undermine the objectivity of evolutionary cladistics. That is why a group of evolutionists, including Colin Patterson, broke away to found the more objective transformed cladistics.
14. Wagner writes: “certain conceptualizations of homology, as for example those made in the cladistics tradition of taxonomy, are incompatible with this program” (p. 4).
15. Wagner fails to seriously discuss the separate-versus-shared problem. It is effectively omitted. Instead, he often speaks of “individualization”, which does not reveal the problem and which obscures the complex mechanisms (e.g. targeted genetic reorganization) necessary to achieve it. He considers individualization so unimportant, it is omitted from his extensive index.
16. Also, Wagner writes: “Novelties likely require large-scale reorganizations of the gene regulatory network” (p. 125).
17. Wagner writes: “To this point, [evolutionary] research on the origin of paired appendages in vertebrates has not provided a coherent explanation” (p. 333); and “we still struggle with some of the most fundamental questions regarding the fin-limb transition” (p. 334).
18. This evolutionist desire—to neatly disallow or minimize genetic side effects—caused evolutionists to commonly assume ‘hierarchical homology’, where the gene networks have *hierarchically circumscribed* side effects. Wagner says evolutionists have to “emancipate” their thinking from that idea, because the evidence shows, “Homology is not hierarchical” but instead it is “cross-cutting” (p. 420–422). This ‘cross-cutting’ genetic pattern—or many-to-many relationship between characters and genes—is expected by Message Theory (see below).
19. On the other hand, evolutionists actively embrace pleiotropy on those rare occasions *when it helps* their storytelling.
20. Wagner uses various names for collections of genetic material that are larger than a gene, and that control development of organs and body plans, and that may incorporate positive and/or negative feedback. He uses terms such as: gene regulatory networks, Core Regulatory Complex, and Character Identity Network.
21. Or perhaps a well-circumscribed group of effects, that just happen to correlate with the traits Wagner wants exposed to selection.
22. Also, recall that the process of separating the genetics—even if precisely targeted—would have no immediate selective benefit.
23. Creation theory, as traditionally practised, does not actually *predict* the limits to biological change. Instead, the limits to biological change were *observed* and used as evidence *against* evolution, and *for* creation.
24. More precisely, design goal 3 predicts the organismal changes that can be experimentally demonstrated (say, in the breeding pens) will always be much smaller than the large gaps in the record of life. Though design goal 1—that life-forms be reasonably designed for survival—allows some ability of life-forms to adapt for survival in changing environments. Message Theory claims tradeoffs had to be made to achieve all three design goals simultaneously—and this was reasonably accomplished.
25. Message Theory expects structural changes to basic body plans (i.e. phylum characteristics) should tend to be the *most limited* (and hardest to achieve experimentally), with somewhat looser limits on less generalized designs (e.g. class characteristics) and so forth (e.g. to orders, to families, etc). This helps life resist macro-evolutionary explanations. The easiest changes to experimentally demonstrate will be those characteristics at the species and genera levels, such as colouration or length of a leg bone.
26. I am not aware of this yet being discovered.
27. Williams, A., Astonishing DNA complexity demolishes neo-Darwinism, *J. Creation* 21(3): 111–117, 2007; creation.com/images/pdfs/tj/j21_3/j21_3_111-117.pdf.

A very shallow anti-creationist book that emphasizes logic but is devoid of it

The Three Failures of Creationism: Logic, Rhetoric, and Science

Walter M. Fitch

University of California Press, Berkeley, CA, 2012

John Woodmorappe

The author was Professor of Ecology and Evolutionary Biology at the University of California at Irvine, before his passing in 2011.

In the introduction, written by evolutionist Francisco Ayala, the reader encounters the hoary quoted statement of Theodosius Dobzhansky: “Nothing in biology makes sense except in the light of evolution” (p. ix). Evidently, Fitch, Ayala, and Dobzhansky all conveniently forget the works of many pioneering biologists—such as Linnaeus, Mendel, Pasteur, and many others—who made perfect sense of biology, and major advancements in the biological sciences, while disbelieving in evolution.

The first part of this book resembles an introductory work on logic and elementary logical fallacies. For instance, he mentions the straw man fallacy, yet that is what he engages in. Thus, he complains that creationists think of evolution as a religion because some of its advocates are zealous (p. 46). This completely misrepresents the creationist position. Evolution is a religion not because of the zealousness of some of its proponents, but because, owing to the fact that it deals with past events, it involves faith in non-observed events, just as does special creation. It also attempts to provide answers to the same big questions as theistic religions:

where we came from? (pond scum); what is our purpose? (reproduce); what is our destiny? (fertilizer).

From then on, the author gets into theology and science, aiming his remarks at both creationists and Intelligent Design advocates. The reader looking for something new can stop right here. There is nothing. In addition, there is so much naivety in this book that one would have to write a separate book to address each issue.

The author mentions isotopic dating. His remarks show not the slightest understanding of what creationists actually believe about isotopic dating, and he exhibits not even the foggiest awareness of creationist efforts in this field, such as the RATE Project.

Contrived ambiguities: figurative Genesis ‘days’ yet again

Fitch repeats the argument that ‘day’ has ambiguous meaning until it is defined in Genesis 1 for the first time. The *reductio ad absurdum* is obvious. It is as silly as saying that ‘God’ is ambiguous until God is specifically defined in the Bible for the first time! It also means that other terms in the Bible must also have ambiguous meanings until they are defined in the Bible for the first time, and—worse yet—terms that are used in the Bible but are never specifically defined in the Bible must forever be ambiguous.

In reality, the reader comes to the Bible with prior knowledge of what terms such as day and God mean. There is thus no more ambiguity in the term ‘day’ than there is with the term ‘God’.

The word ‘day’ or ‘days’ is used throughout Scripture, yet Genesis 1 is

The Three Failures of Creationism

Logic, Rhetoric, and Science

WALTER M. FITCH

the only place in the Bible where the word ‘day’ is supposedly ambiguous (figure 1). Why? After all, no one suggests that maybe Jonah spent three indefinite long periods of time in the whale, or that our Lord spent three indefinite long periods of time in the tomb, or that we work for six indefinite periods then rest for one (note that the 4th commandment in Exodus 20:8–11 is based on Creation Week). To ask this question is to answer it. The ‘ambiguity’ about the meaning of ‘day’ in Genesis 1 is a contrived one. It stems not from any uncertainty in the meaning of the word ‘day’. It comes from attempting to force Genesis 1 to agree with evolution or billions of years.

The author adopts a “We cannot know if it is literal or not” attitude towards the Bible, comparing the situation to the saying “Ah, it was a real rat race!” being non literal (p. 99). His argument has multiple flaws. In the first place, common sense tells us that statements are literal unless we know otherwise. If it were not so, there would be mass confusion, as we would always be wondering whether or not someone’s statement is literal.

In addition, there are principles for determining whether a biblical verse is

literal or not. This is based on the kind of writing and prior knowledge about the matters it raises. For instance, we know that the “rivers clapping their hands” (Psalm 98:8) is not literal for both reasons. The Psalms are a kind of writing that is centred on worship and personal religious experiences, not the transmission of factual information, and we have prior knowledge of the fact that rivers do not have hands and are inanimate objects.

The same holds for everyday conversation. Statements are literal unless unambiguously not. Thus, for instance, we know that the ‘rat race’ comment is not literal because we have the prior knowledge that humans can never actually be transformed into rats. However, were it in fact possible for humans to become rats, we then could no longer freely use the ‘rat race’ comment as it stands, at least without qualification about what we mean whenever we use that phrase.

Old chestnuts—Gilgamesh Epic and JEPD—trotted out

The author is enamoured of the Gilgamesh Epic as the ‘original’ Genesis account, even calling it a ‘bestseller’ of sorts in ancient times. He wilfully disregards alternative explanations for parallels between the two, such as Genesis being the original and Gilgamesh the pagan distortion, and exaggerates the similarities between the Gilgamesh Epic and the Genesis account.¹

Fitch also dusts off the JEPD hypothesis on the origin of the Pentateuch, citing Genesis 1 and Genesis 2 as two separate creation myths. He presents the JEPD with considerable detail, and with unwavering certitude. Ironically, even many liberal theologians have distanced themselves from it. Conservative theologians refuted JEPD long ago.^{2,3}

The author’s childlike evolutionary faith

The author’s faith (and I stress faith) in evolution was venal. For instance, he commented: “Evolutionists may not yet know all the details of how an eye evolved, but that does not mean that the eye didn’t evolve” (p. 132). Oh really? Then how do we know that it evolved?

The author also made the following leap of faith:

“Small change can be observed in laboratory experiments and in the field. There is persuasive evidence that these small changes accumulate over time, as seen in common morphological structures, DNA sequences, similarities in embryo development, the fossil record, and the geographic distribution of species. Macroevolution is simply cumulative microevolution” (p. 129).

Ironically, there are evolutionists who reject the premise that macroevolution is just straightforward time-expanded microevolution. Author Fitch is engaging in the old ‘given enough time, anything can happen’ magical thinking.

In addition, all of the ‘evidences’ he cites for macroevolution are not. They are inferential in nature, and they all can be explained without evolution.

Some of Fitch’s apologetics for evolution is nothing short of abysmal. For instance, he rejects creationist arguments about the astronomical improbability of protein synthesis with the counter-argument that a chain of messenger RNA exists that specifies what the next amino acid in the protein should be (pp. 63–64). But that is in a functioning organism! It tells us nothing about how specific proteins assembled themselves, spontaneously, out of a sea of amino acids, in the absence of messenger RNA.

The evidence supports evolution ... except when it doesn’t

The author claims that similarities among living things consistently support their interrelatedness. For instance, humans and chimps are more similar to each other than to other primates. However, Fitch comments:

“As usual, things are imperfect in biological tests. If one chooses many triples of characteristics for the gorilla, chimpanzee, and human triple, one gets human-chimp pairs most often, but one also gets a sizable number of chimpanzee-gorilla pairs plus a few human-gorilla pairs. The problem is that the species are all too closely related to each other for the amount of information available to separate them. The fault lies not with Darwinism but with a lack of data—a lack of a sufficient number of varied characters” (p. 96).

How predictable! How classic! The problem is never with evolution. The problem is always with the data.

There is a line of evidence not mentioned by Fitch—the SINES. These are retroposons that are supposed to be the most reliable means of deciphering



Figure 1. The use of the word ‘day’, throughout Scripture and in Genesis 1, is unambiguous

evolutionary relatedness. After all, SINES almost never get inserted in the same spot in homoplastic fashion, and they almost never get excised without leaving behind warning evidence that this has happened. Even so, some SINES support a gorilla–human–chimp clade instead of the accepted gorilla–chimp–human clade. Since evolution cannot possibly be wrong, a rationalization has to be invoked. It is this: The human–chimp divergence happened so soon after the gorilla–chimp–human divergence that some SINES had, owing to incomplete lineage sorting, fortuitously gotten shared by gorillas and humans but not chimps.

Same old song of ‘bad’ design— Fitch confuses the issue

Fitch argues that imperfect designs imply an imperfect designer. This is, first of all, based on nothing more than somebody’s opinion about a structure being poorly designed. He trots out all the examples of ‘bad’ design in humans—including ones (such as the appendix and the ‘backwards’-wired retina of the human eye) that have been soundly debunked—and cites this as evidence against a designer.

Fitch also argues that the sub-optimization of some designs, such that the overall structure is relatively optimal, implies a Creator who does not know how to simultaneously optimize all designs in a creature. This is a *non-sequitur*. It ignores the possibility of a designer who limited Himself, by choice, to finite materials. The Designer is not finite, but the materials He decided to work with are finite. If the designed object were perfect in every conceivable way, it would not be a creation of God. It *would* be God.

However, this entire discussion is academic, as it confuses the issue. The issue is not whether or not a structure is good or bad design (whatever that means), but how it is that the structure exists *at all*. For instance, if one

were to find hieroglyphics on a rock from the moon, it would be futile to quibble about whether they were elegantly written or not, or whether or not they concurred with somebody’s opinion about good prose. One would, instead, wonder in astonishment about what kind of intelligent entity (extraterrestrial life) produced these hieroglyphics.

Second Law of Thermodynamics—Fitch confuses the issue

The author dusts off the old saw about open systems vitiating creationist contentions about the Second Law of Thermodynamics. The real issue is not open or closed systems. It is the presumably spontaneous origin of functional specified complexity which is equivalent to a reduction of *configurational* entropy.⁴

Consider, as an analogy, the watch. The watch only tells time because of the functional specified complexity that is inherent in the parts being specifically designed, machined, and assembled to interact in a very narrow, specific way. The thermodynamics of the metal itself is irrelevant to the function of the watch.

Let us now make an open system by delivering heat to the watch. The entropy of the metal atoms increases. The solidity of the metal is lost, and we now have liquid metal. Solid to liquid is an increase in entropy in itself because the atoms have much greater randomness. The entropy increase of a watch melting is even greater because of the low configurational entropy it started with. Now let the open system function by letting the heat depart, so that the liquid solidifies. We have regained the solidity of the metal, which is a local loss of entropy in itself. However, we have not regained the functioning watch because it could not return to the state of low configuration. All we now have is a useless blob of metal. Clearly, open or closed systems are

irrelevant to the fact (or otherwise) of the function of the watch (other than, of course, potential issues related to such factors as the temperature of the watch’s parts).

The low configurational entropy (useful specified complexity) is in no way a property of the metal. It does not originate spontaneously, regardless of whether or not the watch is an open or closed system. It is, instead, solely, and inevitably, the product of an intelligent designer.

Irreducible complexity on hemoglobin—Fitch confuses the issue

The author tries to get around the irreducible complexity of hemoglobin by calling attention to the different kinds, and sophistications, of hemoglobin that exist among living things. He is, first of all, begging the question, by assuming the fact of evolution in order to support the possibility of evolution.

His argument, in addition, is a *non-sequitur*. The irreducible complexity of a feature does not disappear merely because there are simpler versions of that feature in existence. Moreover, the simpler versions operate under the constraints of their own irreducible complexities.

As an analogy, consider the gas-powered drivable lawnmower, the gas-powered hand-pushed lawnmower, and the non-motorized hand-pushed lawnmower. We have three levels of sophistication in terms of lawnmowers. Following Fitch’s logic, one could argue that the most sophisticated one, the gas-powered drivable lawnmower, is not irreducibly complex because less-sophisticated functional lawnmowers exist. Against such nonsense, one could remove a major part of it and observe its non-function.

In fact, all three forms of lawnmowers have their own irreducible complexities. None of them can function at all unless all, or virtually

all, of their components are simultaneously in place.

Finally, the fact of the existence of three levels of sophistication begs the question about their origins. Following Fitch's reasoning, one would have to concur that the existence of three levels of sophistication demonstrates the capability of lawnmowers to arise through spontaneous, non-intelligent, evolutionary processes.

Natural selection, a non-tautology?—Fitch again confuses the issue

Now consider 'the survival of the fittest'. Fitch denies that this is a 'survival of the survivors' tautology, by claiming that experiments can be done to test the adaptive value of a structure. For instance, the idea that a long tail helps the bird find a mate can be tested by shortening the tail and observing whether it hinders his acquisition of a mate.

There are several layers of fallacies immediately apparent in his reasoning. If a clipped tail causes the male to be avoided by females, does it prove that the tail evolved for mate-attraction, or does it merely show that females tend to avoid males that have mutilated or atypical bodies? Second, Fitch's reasoning avoids the problem of exaptation. What if the long tail originally evolved in response to selection pressures unrelated to mating and only recently became evolutionarily co-opted as a mate-attractant?

Pointedly, the real issue, confused by Fitch, is not 'survival of the fittest'. It is the *arrival* of the fittest. Even if the long tail unambiguously helps the male attract females, and even if we could have some way of knowing that it has *always* done so, it tells us nothing about how the long tail *arrived*, even within the context of evolutionary thinking. Instead, the speculation and storytelling only begin. When and how did the long tail contribute to the 'survival of the fittest' of the bird? Did an ancestral bird have a

mutation that gave it an unusually long tail, and did this persist for millions of years as a neutral mutation before some female finally 'discovered' its attractiveness? Or did an ancestral male bird have a mutation that gave it an unusually long tail, inducing the females to immediately go crazy over him? Alternatively, was all this a step-by-step co-evolutionary process, wherein a slightly longer tail generated a slightly heightened female interest, and this became a feedback loop that led to still-longer tails and still-greater female interest in them?

A more basic factor needs to be considered. The vast majority of adaptations in nature are deduced on the basis of what the structure does for the organism. Their inferred evolutionary origins are based on scenarios and storytelling, not experimental evidence.

Finally, many of the believed crucial evolutionary events were one-time occurrences that happened long ago, and the speculated causes for these events are impossible to test experimentally. In addition, the testing of the survival value of an adaptation is of dubious relevance to its speculated evolutionary origins, even if one reflexively believes in an evolutionary origin. For example, it would be futile to argue that land-dwelling creatures necessarily evolved into existence so that such creatures could escape the attentions of predatory fish, even though the simplest experiment would demonstrate the obvious—that land-dwelling creatures are almost always out of reach of predatory fish.

Finally, the erroneous conflation of 'survival of the fittest' with 'arrival of the fittest' goes to the very heart of the creation–evolution issue. Permit another analogy. Imagine a group of aliens landing on Earth and becoming fascinated with automobiles. Dutifully experimenting with the 'survival' value of each component of the car, they do an experiment wherein they remove the motor and observe what happens. They quickly deduce that

the 'survival of the fittest' requires the automobile to have an engine to even move. However, this experimental find is totally irrelevant to the *real* issue—the 'arrival of the fittest'. Did the car and its engine originate by intelligent design, or did it originate by spontaneous natural processes?

Conclusion

This book is very superficial. Author Fitch's reasoning is very shallow, with uncritical repetition of very stale arguments. In addition, he seems to be stuck in a time warp. The author consistently brings up matters that creationists had dealt with long ago. He shows almost no understanding of the many scientific developments in creationism in recent decades.

The author titles this book as the *Three Failures of Creationism*. At the risk of being a bit uncharitable, I think it more valid to conclude that his reasoning is the biggest failure of all.

References

1. Osanai, N., *A comparative study of the flood accounts in the Gilgamesh Epic and Genesis*, MA Thesis, Wesley Biblical Seminary, USA, 2004; creation.com/gilg.
2. Phelan, M.W.J., *The Inspiration of the Pentateuch* Twoedged Sword Publications, Waterlooville, UK, 2005.
3. Holding, J.P., Debunking the Documentary Hypothesis, review of Phelan, ref. 2, *J. Creation* 19(3):37–40, 2005.
4. Thaxton, C.B., Bradley, W.L. and Olsen, R.L., *The Mystery of Life's Origin*, ch. 8, Philosophical Library Inc., New York, 1984; available online at idolphins.org/mystery/chapt8.html.

Science saturated with racism

Race Unmasked: Biology and Race in the 20th Century

Michael Yudell

Columbia University Press, New York, 2014

Jerry Bergman

This book makes an important contribution to understanding the origins of one of the most fundamental problems in contemporary society and science, namely what is race, and are the races, however defined, biological equals. Yudell, Associate Professor at the School of Public Health, Drexel University (Philadelphia), charts the evolution of the ‘scientific’ race concept during the last century to today, with a particular focus on eugenics and its history in the USA, focusing almost entirely on the problem between the black and white ‘races’. Yudell documents that there is often more genetic diversity within a given racial group than between any two races, yet race is still critical, sometimes disturbingly so, in its political and social applications.

The book also documents the enormous harm that eugenics and its applications to social policy have caused. This was summarized by one author who wrote: “In the 1930s, America was infatuated with the pseudoscience of eugenics and its promise of strengthening the human race by culling the ‘unfit’ from the genetic pool.” These “unfit” humans included:

“... the ‘feeble-minded’, insane, and criminal, those so classified included women who had sex out of wedlock (considered a mental illness), orphans, the disabled, the poor, the homeless, epileptics, masturbators,

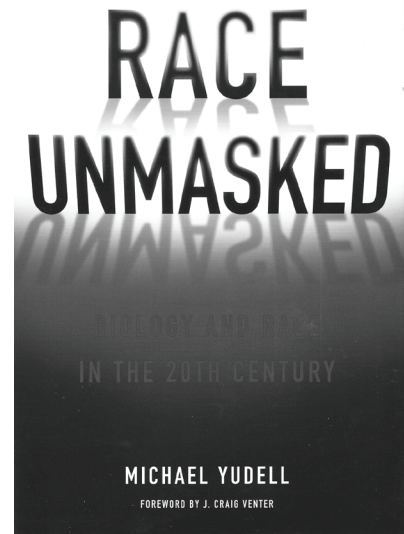
the blind and the deaf, alcoholics, and girls whose genitals exceeded certain measurements. Some eugenicists advocated euthanasia, and in mental hospitals, this was quietly carried out on scores of people through ‘lethal neglect’ or outright murder.”¹

An example she includes occurred at one Illinois mental hospital:

“... new patients were dosed with milk from cows infected with tuberculosis, in the belief that only the undesirable would perish. As many as four in ten of these patients died. A more popular tool of eugenics was forced sterilization, employed on a raft of lost souls who, through misbehavior or misfortune, fell into the hands of state governments. By 1930 ... California was enraptured with eugenics, and would ultimately sterilize some twenty thousand people.”¹

In the end, “social prejudices became scientific” which justified a wide variety of abuses (p. 18). This field, one that Hillenbrand called a pseudoscience, was embraced by many “well-respected geneticists” who concluded that “the Negro race differs greatly from the white race, mentally as well as physically” (p. 15).

Francis Galton, Darwin’s first cousin, borrowed heavily from Darwin, writing that, as an inferior race, the “negro may himself disappear before alien races, just as his predecessors disappeared before him” (p. 28). To Galton “race improvement was ‘so noble in its aim’ that it rose to the level of ‘religious obligation’” (p. 29). Furthermore, Galton’s writings were “read widely” and greatly influenced not only the eugenic movement but also governmental policy (p. 19).



Almost all leaders of the various racist eugenic movements were academics with Ph.D.s from leading universities, a virtual “‘who’s who’ of the natural and social scientists of the time” (p. 77). The leading eugenicist, Charles Davenport, had a Ph.D. from Harvard. Dr Harvey E. Jordan, Professor of Embryology, and later Dean of the College of Medicine at the University of Virginia, had a Ph.D. from Princeton University. Yudell described him as “a noted eugenicist and racist” (p. 38). Paleontologist Henry Fairfield Osborn was head of the American Museum of Natural History in New York City for over 25 years, during which time he accumulated one of the finest fossil collections in the world. Johns Hopkins University Professor of Biostatistics and Genetics, Dr Raymond Pearl, was a leading eugenicist who researched the “racial pathology” of blacks compared to whites (p. 69). The implication of his research was that certain internal organs of blacks “were somehow more primitive” than those of whites, and the same organs of whites “represented an evolutionary advance” (p. 71).

As Yudell makes clear: “social Darwinism and craniometry were the scientific backbone of a 19th century

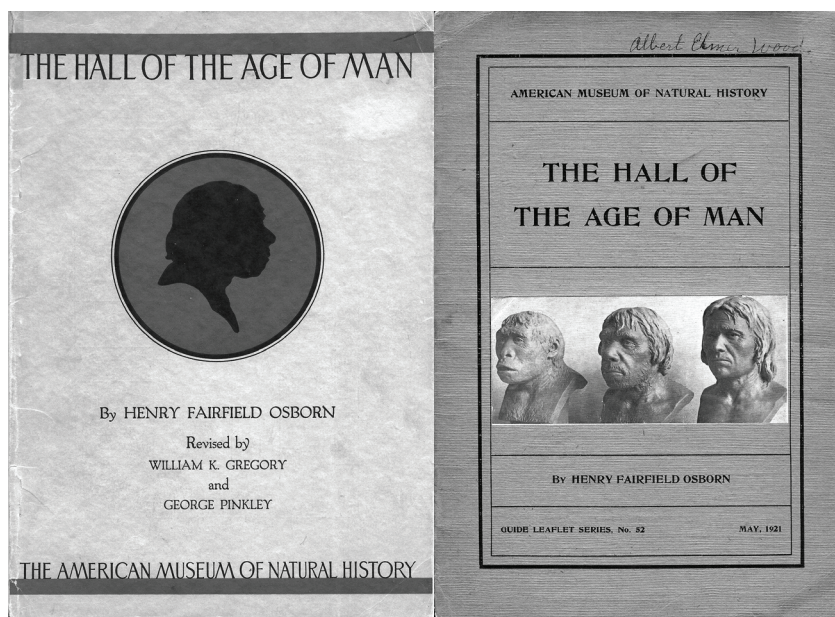


Figure 1. Two covers of Henry Fairfield Osborn's book *The Hall of the Age of Man*

understanding of race, then in the 20th century eugenics [provided] the formative language of modern racism" (p. 2). In fact:

"... the biological race concept, as we understand it today, originated with eugenic theories of difference and was re-created and integrated into modern biological thought by population geneticists and evolutionary biologists in the 1930s and 1940s during the evolutionary synthesis in biology (the union of population genetics, experimental genetics, and natural history that reshaped modern biology)" (p. 6).

The main applications of eugenics in America and other countries, such as Sweden, were the large sterilization programs (63,000 in the United States alone) and immigration restrictions, especially of Jews, as codified in the Johnson-Reed Act of 1924 (pp. 9, 10, 14). The main reasons for these immigration restrictions were to keep people that had "bad germ plasm" out of America and to stop other countries from pouring their "pestilential sewage into our reservoir" (p. 32).

Osborn was a main force behind lobbying congress for "sweeping

immigration restrictions" (p. 33). Osborn pushed the claim that certain "countries are now striving to keep the desirable people at home, and are sending the undesirables, especially the Jews, to America" (p. 33).

Harry Laughlin, the superintendent of the Eugenics Record Office at the Cold Spring Harbor Laboratory, "ferently promoted the eugenics cause", maintaining that "recent immigrants from eastern and southern Europe were afflicted 'by a high degree of insanity, mental deficiency, and criminality'" compared to past immigrants, polluting America's racial stock (p. 34). Consequently, "eugenics was, in many ways, the most compelling ideology generating support for the bill" (p. 34). As a result of the bill most of those kept out of America were Jews and persons from Eastern Europe.

The impact from the "push to integrate eugenic theory into American immigration policy by Osborn and others was considerable, and the consequences" had clear

"... damaging effects on both immigrants to the United States and eventually on those who died in the Nazi genocide against the Jews in

Europe. Federal immigration restrictions were, as such, buoyed by eugenicist sentiment" (pp. 33–34).

Harry Laughlin appeared before Congress several times in the early 1920s promoting the belief that immigration was foremost a "biological problem" (p. 34). In the 20th century, it was primarily the field of eugenetics,

"... from which racial scientists freely exploited both language and prestige. This legacy can be explained largely by the history of genetics itself, which at its founding was inseparable from the eugenic theories that were mired in examining hereditary traits both within and between human races" (p. 3).

Science 'fact' of Negro inferiority

A leading medical journal, *American Medicine*, editorialized in support of the conclusion that "no amount of training" will cause the black race's "brain to grow into the Anglo-Saxon form", indicating that studies have proved an "anatomical basis for the complete failure of Negro schools to impart the higher studies" (p. 54). In 1909, Professor Franklin Mall tried to verify the claim that black brains were significantly smaller than white brains, without success. He

"... could find no significant differences between black and white brain structures. 'I have now had considerable experience in the dissection of the Negro and have yet to observe that variations are more common in the Negro than in the white', Mall wrote in a rebuttal in the *American Journal of Anatomy*" (p. 54).

Nonetheless, "ideas about racialized anatomy quickly became the scientific and popular norm, while Mall's work had little impact" (p. 54) in spite of much contrary evidence, such as the "black high school" that academically outperformed at least two "white schools" in the district as

far back as 1899! The school called M Street School was later renamed Dunbar High School in 1916. Their outstanding academic success continued until about the 1950s, due to inappropriate external decisions.² Other examples were documented by scholar Thomas Sowell, who has written extensively on racial relations.

The Ku Klux Klan

The Klan often exploited the literature of the eugenic scientists, and some scientists even worked to support their racist agenda. For example, historian Lothrop Stoddard advised the Klan on race matters and, in 1923, was shown to be a member of the Klan (pp. 41–42). He also implored Klan members to read his book *The Rising Tide of Color Against White World-Supremacy*, which claimed that non-whites were reproducing far more rapidly than whites. Negroes, he warned, remain savages and their increasing dominance will eventually be disastrous for white society. Stod-

dard lectured to audiences as large as 4,000 members (p. 103).

Henry Fairfield Osborn was also actively involved in supporting eugenics by his work in the International Congress of Eugenics; the second was held at the American Museum of Natural History in 1921 (p. 43). Their goal was to use race betterment programs to improve and evolve humanity. The museum, “one of the world’s leading institutions for anthropological thought”, was active in supporting numerous other eugenic programs (p. 47).

Presenters at the conference included leading scientists, such as Professors Sewell Wright and L.C. Dunn, telephone inventor Alexander Graham Bell, and Dr Thomas Garth and zoologist Theophilus Painter, both from the University of Texas. Dr A.H. Schultz, Department of Embryology at Carnegie Institution, Washington D.C, compared white and Negro fetuses (p. 51), and Painter’s presentation was on the chromosomes of whites and blacks, purporting to show subtle but,

he thought, significant differences between them.

Osborn had a permanent display at the museum on eugenics titled *The Hall of the Age of Man* (see figure 1). Yudell described Osborn as a “notorious anti-Semite and an active booster of Nazi Germany” (p. 47). Osborn even visited Nazi Germany, “enthusiastic” about its eugenic programs. For his work in this area he received an honorary degree at Johann Wolfgang Goethe University in 1934 (p. 47).

In the end, an exhibit on eugenics set up in conjunction with the congress drew between 5,000 and 10,000 visitors (p. 49). Race and human evolution was a theme in all of the booths. The attendees included many college and university professors plus investigators in various scientific institutions who, no doubt, took the ideas gleaned from the exhibit back home to their students and colleagues.

American eugenics and Nazism

European political events, specifically the rise of Nazism, helped to popularize the link between race and genetics. The German biologists “actively and without compunction sought” to apply eugenics to their society, and to “a significant degree, Nazi eugenic zeal was inspired by American eugenics” (p. 108). Madison Grant’s eugenic apologetic *The Passing of the Great Race: The Racial Basis of European History*, was read by many Nazis:

“... its ideas about Nordic racial purity influenced many Germans. In a letter to Grant, Hitler called *The Passing* ‘his Bible’. In 1933 the *Eugenical News* ... noted the American influence on German sterilization policy: ‘To one versed in the history of eugenic sterilization in America, the text of the German statute reads almost like the American model sterilization law’” (p. 108).

Furthermore:



Figure 2. The KKK was very active for several decades in the United States, not only in the South but also in the North in some states such as Indiana. Their influence was so high in some areas that to be elected to a high level political office in some states required the endorsement of the KKK. The KKK also enjoyed significant support from academia, which helped to boost their scientific legitimacy.

“American philanthropists, including those of the Rockefeller Foundation, also gave scientific grants to German eugenicist researchers, both before and for several years after the rise of Hitler. And even as the world recoiled in horror at the ways in which the Nazis integrated eugenics into their political philosophy—mass sterilizations and concentration camps—American eugenicists continued to support their Nazi brethren” (p. 108).

The Nazis were so grateful for the help of Americans that several were awarded honorary doctorates from major German universities. One example came in 1935 when Harry Laughlin was awarded

“... an honorary degree from the University of Heidelberg for ‘being one of the most important pioneers in the field of racial hygiene.’ The dean of the University of Heidelberg’s medical school later helped organize the gassing of thousands of mentally handicapped adults” (pp. 108–109).

In another example, after a 1935 visit to Berlin,

“... the head of the Eugenic Research Association, Clarence Campbell, proclaimed the Nazi eugenic policy ‘sets a pattern which other nations and other racial groups must follow if they do not wish to fall behind in their racial quality, in their racial accomplishments, and in their prospects for survival.’ Finally, in 1937, American eugenicists distributed a Nazi eugenic propaganda film to promote the eugenic cause in the United States” (p. 109).

The eugenics movement ends

A major factor that spelled the end of the eugenics movement was the “worldwide reaction to the eugenical horrors” that occurred in Nazi Germany as well as the effects of the

American Civil Rights Movement in the 1960s (p. 8).

A major historical fact is that, although humans were historically divided into language and national groups, classifying “human variation in blood or in kinship [genetic] groups is a relatively new way to categorize humans” (p. 25). In other words, the main way of grouping people in the past was based on their national origin, such as an Assyrian or an Egyptian. Only after Darwin, were people commonly also divided on the basis of biology, i.e. physical traits such as skin, eye, and hair colour.

Summary

In short, “Eugenic research throughout the 1920s continued to integrate” the idea that some races were superior to other races into

“... political advocacy, increasingly in the area of black-white difference. The language of science and the language of heredity were integrated into the American zeitgeist to become the intellectual justification behind the pernicious ideology of American racism. In the remainder of the 1920s, with eugenics at its most popular and powerful, the followers of the movement continued the work begun by Francis Galton” (pp. 55–56).

As Professor Yudell documented, most of the leading American eugenicists during this period were professors of biology or anthropology affiliated with leading American universities. This book is highly recommended as a well-documented (the 55 pages of notes and references are in pp. 219–274) review of this now very embarrassing history, a movement inspired by Charles Darwin’s theory.

It must be added that America’s academics are only partly responsible for the rise of racist Nazi Germany. Germany’s own Darwinism was quite sufficient to wreak havoc on German

society as amply documented in Richard Weikart’s book, *Hitler’s Ethic*,³ and the influential eugenic works of Ernst Haeckel—his book, *The Wonders of Life*, is an excellent example of his eugenic crudeness. Conversely, some American anthropologists, such as Jewish anthropologist Franz Boas and his students, including Ruth Benedict, were critical in the eventual overthrow of the racist foundation in anthropology and other fields.

References

1. Hillenbrand, L., *Unbroken: A World War II Story of Survival, Resilience, and Redemption*, Random House, New York, p. 11, 2010.
2. Sowell, T., Will Dunbar Rise Again? jewishworldreview.com/cols/sowell1050114.php3#VjrBYW7Dg3h, 1 May 2014.
3. Weinberger, L., A review of *Hitler’s Ethic*, by Richard Weikart, *J. Creation* 24(2):17–20, 2010.

What does the Bible say about the fabric of space?

Alan Pace

Three key words used in the Bible to describe space are examined. The Hebrew word *shachaq*, commonly translated as skies, describes things that were made firm or hardened through a casting type process. This helps to make sense of the word firmament which is related to the Hebrew word *raqa* (to beat, hammer out or spread out, e.g. metal). The heavens are like the finished goods of this manufacturing process. The language of Scripture not only hints at the heavens being like a fabric but suggests they are thin in a fourth spatial dimension, as observed by another author. Together, these words provide a biblical filter for evaluating theories and models of this medium.

In 1994 Russell Humphreys published a book which listed his now famous 17 verses on the stretching out or spreading out of the heavens. He also listed some key verses which strongly suggest the heavens are an actual material. Furthermore, some of these descriptions of the heavens suggest this material is thin in another spatial dimension.¹ Many of the current physics theories seem to make reference to some sort of medium or fabric of space but the concept is usually shrouded in more technical terms with a strong reluctance to use the politically incorrect word *ether*.² More recently, Humphreys has taken these concepts further with a new model for how gravity works based on a four-dimensional fabric of space that has tension in it. In his model this fabric is greatly accelerated uniformly in the fourth dimension.³

In 2011, John Hartnett reviewed the Bible's meaning of *natah* (to stretch or bend) in relation to the cosmos, concluding, "there is not a single verse in the Bible applied to the cosmos with the meaning of a rubber sheet, where space might have been stretched by some enormous factor [emphasis in the original]".⁴ Fifteen years earlier, Charles Taylor also pointed out that the stretching of *natah* does not imply expansion.⁵

This paper shares some insights from the Bible on how the Hebrew word *shachaq*, commonly translated as skies or clouds, seems to relate to the fabric of space, directly linking to the processes connected with the firmament. It also reviews what the Bible says about the firmament and the heavens, resulting in a collection of statements that a biblical model of the fabric of space should be consistent with.

The skies

The Hebrew word *shachaq* is used 21 times in Scripture:

- In one occurrence it means a speck of dust (Isaiah 40:15).

- In the remaining 20 occurrences it is translated as clouds, skies, or sky. It is normally found in the plural form in Hebrew except for the two occurrences in Psalm 89.
- The related Hebrew verb is used four times in the Old Testament and means to beat, pound, grind up, or erode.

While skies or clouds may be suitable translations into modern-day English most of the time, there are some descriptions of this word which don't seem to fit. They may be clues to the structure of the fabric of space.

Strong

There are three verses that talk about the strength of *shachaq*:

- Psalm 68:34—"Ascribe strength to God; His majesty is over Israel and His strength is in the skies [*shachaq*]" (NAS). God's strength is in the *shachaq*!
- Proverbs 8:28—"When He made firm the skies [*shachaq*] above, when the springs of the deep became fixed" (NAS). The verb used in relation to the skies means to strengthen, make firm or harden. This verse seems to be giving us a clue as to the changes that happened when God was creating the world.
- Job 37:18—"Can you, with Him, spread out [*raqa*] the skies [*shachaq*], strong as a molten mirror?" (NAS). The word for molten is often translated as cast. So again we see the Bible emphasizing the strength or hardness of *shachaq*. This verse also uses the word *raqa* (to beat, hammer out, or spread out, e.g. metal—see the next section on the firmament) to describe one of the activities God went through in making the *shachaq*.

Cast and hardened

Job 37:18 is not the only passage that mentions casting and hardening. In the very next chapter God questions Job in relation to creation, including a mention of *shachaq*:

"Who can count the clouds [*shachaq*] by wisdom,

Or tip the water jars of the heavens,
When the dust hardens into a mass,
And the clods stick together?” (Job 38:37–38, NAS).

The word translated as mass on the third line means a casting and is translated as such in its only other occurrence in Scripture (1 Kings 7:37). So the third line can be translated as “when the dust hardens in the casting”.

The firmament

In Genesis 1:6–8 on the second day, God made the firmament. (Some translations use the word *expanse* or *vault* rather than *firmament*.) Its purpose was to separate the waters into two parts.

If the firmament is the medium for the propagation of light (i.e. electromagnetic waves), then it is important to note that light appeared before this on the first day. Light seems to travel like a wave in the medium and be detected as if it were a particle. Was there a different sort of medium for the light prior to the firmament? If there was no medium, did the light just sit there in one place, separated from the darkness?

Usage of *raqiya*

Raqiya, the Hebrew word for firmament, is used 17 times in the Old Testament. Nine of these occurrences are in Genesis 1 and a further five occurrences are in Ezekiel.

On the fourth day the phrase “in the firmament of the heavens” (NKJV) is used to describe where the sun, moon, and stars are placed. Even though God named the firmament heaven in verse 8, the expanded phrase is still used. Either the author wanted to be very clear as to which firmament was being referred to, or the firmament belongs to, or is a part of, the heavens in some way—or both. The word heaven on its own was not suitable to accurately and clearly describe where the sun, moon, and stars were placed.

On the fifth day a similar phrase is used to describe the place where the birds fly, “across the face of the firmament of the heavens” (NKJV). Humphreys discussed this verse at length in his 1994 book to reject the idea that the firmament refers only to the earth’s atmosphere.⁶

In Ezekiel 1, the prophet has a vision where he describes various things: four living beings, four wheels, the firmament, and a man on a throne. Verse 22 describes an object that has the *likeness* of a firmament. This firmament is above the heads of the living beings and the throne is above this firmament. This passage is not talking about the firmament of Genesis 1:6–8 but something that resembles it in some way. Interestingly, the firmament is described as stretching out or extending over their heads, i.e. in a horizontal direction rather than in a vertical or radial direction. This same word (Hebrew *natah*) is used to describe the stretching out of the heavens—see the next section on the heavens.

There is another reference to this same firmament and the throne in Ezekiel 10. The remaining three verses mentioning the firmament are:

- Psalm 19:1—it is the firmament that shows God’s handiwork (or causes it to be shown).
- Psalm 150:1—“praise him in the firmament of his power” or “mighty expanse”.
- Daniel 12:3—“shall shine as the brightness of the firmament”. The firmament is bright because God has placed lights in the firmament (Genesis 1:14–19), especially the greater light, the sun!

Usage of *raqa*

The Hebrew word for firmament is related in the Hebrew to the verb *raqa*. It is used 11 times in the Old Testament. Here is the range of meanings:

- To beat, hammer, or spread out metal (e.g. Exodus 39:3).
- To spread people out, to disperse (2 Samuel 22:43).
- To spread out the earth above the waters—a reference to the third day in Genesis 1 (e.g. Isaiah 44:24).
- To stamp one’s foot or feet (e.g. Ezekiel 25:6).
- To spread out the skies [*shachaq*] (Job 37:18). (This verse was examined in the section on the skies.)

This verb is applied to the skies [*shachaq*] but never to the heavens. In fact, Isaiah 42:5 and Isaiah 44:24 contain the word *raqa* and mention the stretching out of the heavens. However the earth is the direct object of *raqa* not the heavens. The heavens is the direct object of *natah*, instead. Isaiah, through divine inspiration, has selected one word to describe the spreading out of the earth above the waters and, within the same verse, another word to describe the stretching out of the heavens. The verb that the word for firmament is related to is *not* used to describe the stretching out of the heavens!

The heavens

Stretched out

Humphreys listed 17 verses on the stretching out of the heavens in his 1994 book.¹ These are summarized and grouped in table 1.

Although I don’t classify all 18 descriptions in these 17 verses as describing the spreading out of the heavens, nevertheless, the idea is clearly repeated, with the most common description using the Hebrew verb *natah*. As pointed out in some of the references mentioned earlier, *natah* suggests spreading out or extending rather than the expansion or large scale stretching of some sort of elastic material.^{4,5}

There are three similes we should quickly look at before moving on to the next point. The heavens are:

- Stretched out [*natah*] like a curtain that is used in the tabernacle (Psalm 104:2). The word used here for curtain

Table 1. The 17 verses on the stretching of the heavens identified by Humphreys

Hebrew Verb	Object	Meaning	Verses
<i>natah</i>	The heavens	To bow or bend the heavens (so that God can come down)	2 Samuel 2:10; Psalm 18:9 (parallel passage to 2 Sam 2:10); Psalm 144:5
		To spread out or extend (like a curtain)	Job 9:8; Psalm 102:4; Isaiah 40:22a; Isaiah 42:5; Isaiah 44:24; Isaiah 45:12; Isaiah 51:13; Jeremiah 10:12; Jeremiah 51:15; Zechariah 12:1
	The north	To spread out or extend	Job 26:7
	The likeness of the firmament—not the firmament of Genesis 1	To spread out or extend (like hills or rivers in a landscape)	Ezekiel 1:22
<i>mathach</i>	The heavens	To spread out (like a tent or possibly a folded up sack before putting grain in it)	Isaiah 40:22b
<i>raqa</i>	The skies [<i>shachaq</i>]	To beat, hammer out or spread out (like metal)	Job 37:18
<i>taphach</i>	The heavens	Most probably to span, as in putting up the palms of your hands as a measure	Isaiah 48:13

occurs 54 times in the Old Testament, 44 of these are in Exodus 26 and 36 for the tabernacle curtain. The Gershonites of the tribe of Levi were responsible for carrying these curtains from place to place (Numbers 4:21–28). At each new place the tabernacle, including the curtains, needed to be set up.

- Stretched out [*natah*] like a *fine, thin* curtain (Isaiah 40:22). This word for curtain [*doq*] is different to the one above and occurs only once in the Bible. It is some sort of fine, thin cloth. This noun is related to the verb to crush, pulverize or make into dust but it isn't the same verb that *shachaq* is related to.
- Spread out [Hebrew *mathach*] like a tent (Isaiah 40:22). This word for spreading out occurs only once in the Bible. However, a word for sack is related to this verb and occurs only in Genesis 42–44—the sacks that Joseph's brothers used to carry grain. The tent mentioned in this verse refers to a nomadic tent made out of strips of black goats' hair cloth, sewn together into one large piece.⁷

While the focus of these passages is on how the heavens are being stretched out, spread out, or unfolded, it is curious that in each case the material involved in the analogy seems to be woven. We also see this in the next subsection about the heavens wearing out like a garment. Is this more than coincidental? (It should be noted that the concepts of casting and weaving are not necessarily in conflict as the woven material may be cast originally, as in Exodus 39:3.)

Other descriptions of the heavens

There are several other descriptions of the heavens in the Bible, all of which reinforce the concept that the heavens are something real and tangible.^{1–3} The heavens:

- Can be torn, like tearing your garments to show grief or remorse (Isaiah 64:1).
- Will wear out like a garment (Psalm 102:26; Hebrews 1:11).
- Will be rolled up like a scroll or robe (Isaiah 34:4; Revelation 6:14; Hebrews 1:12). At the same time as this, all the host of heaven will rot away and wither (Isaiah 34:4). Furthermore, Revelation 6:14 uses the Greek word *apochorizo* (*apo* from and *chorizo* to separate or divide) to describe the heavens separating from something.
- Will be shaken (Hebrews 12:26; Haggai 2:6; Isaiah 13:13) and the “powers of the heavens will be shaken” (Matthew 24:29; Mark 13:25; Luke 21:26).
- Will be changed, like changing clothes, swapping the current version with a new version that can't be shaken (Psalm 102:26; Hebrews 1:12; 12:27).

All but the first point refer to future events in the end times.

A fourth spatial dimension

The rolling up of the heavens (Isaiah 34:4; Hebrews 1:12; Revelation 6:14) strongly suggests that there is some dimension in which the heavens are thin and which, presumably, is the same direction that they will be rolled up into.^{1,3}

Assuming that there is a fourth spatial dimension, then the description of the spreading out of the heavens like a curtain or tent (i.e. material that is thin in one of its dimensions) may also be a description of some sort of unfolding in four spatial dimensions rather than just three. Figure 1 shows that a fabric unfolding in a fourth spatial dimension can appear as if normal three-dimensional space is expanding, the scale of which depends on the amount of folding in this fourth

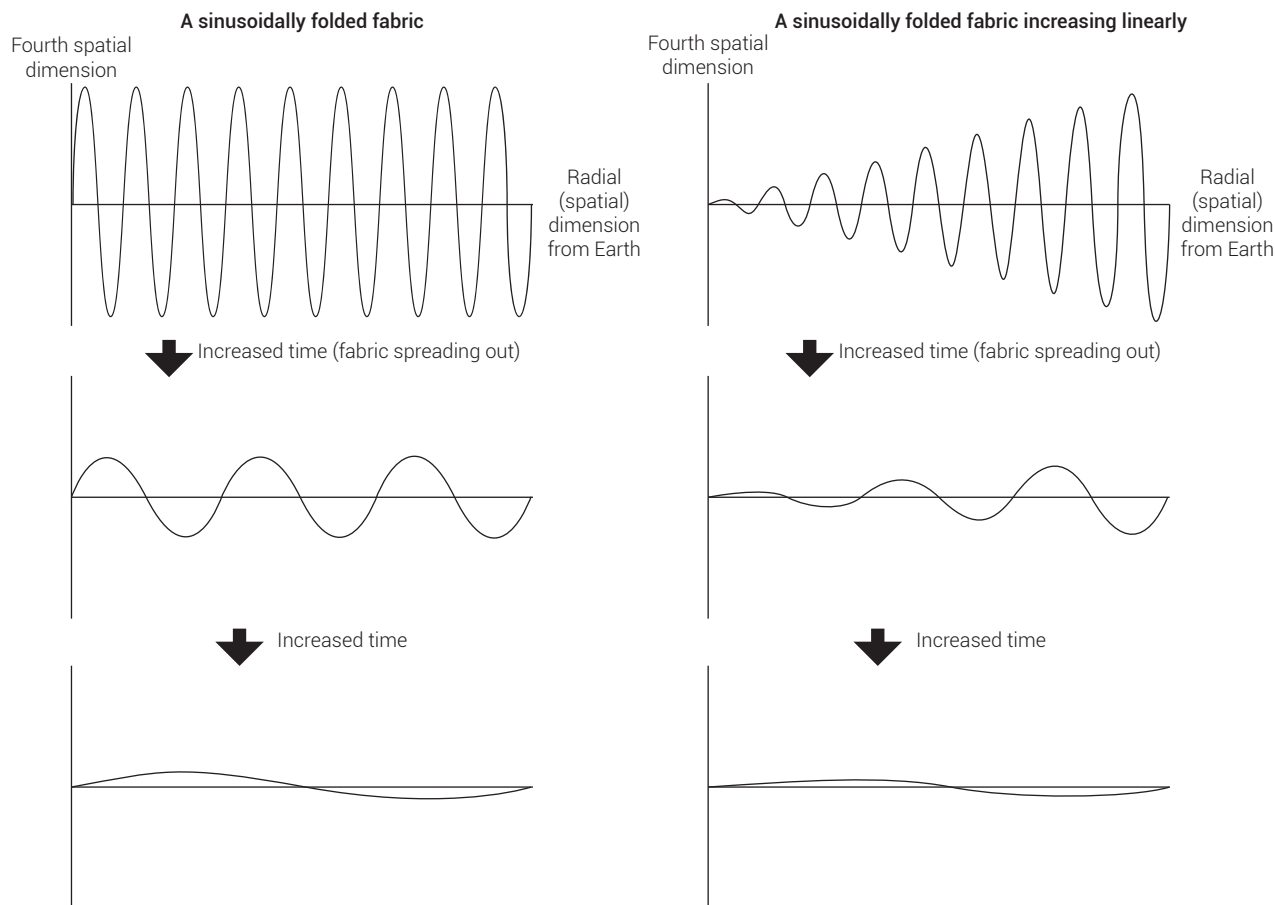


Figure 1. Two examples of how a fabric unfolding in a fourth spatial dimension can appear as if normal three-dimensional space is expanding

dimension relative to our normal three spatial dimensions. The following points need to be stressed about figure 1:

- I have used the idea of a curtain spreading out (Psalm 104:2; Isaiah 40:22). Spreading out a tent (Isaiah 40:22) may look different to this! In reality, we are in the realm of speculative models to try and fit with the hints that we find in Scripture.
- I agree with Humphreys in his recent paper on gravity that it would seem most likely that the majority of this spreading out of the heavens would have been done by the end of the second day of creation.³ If so, this would not help models requiring an expansion of space after the creation of stars on the fourth day in order to resolve the distant starlight problem. But the idea may lead to other concepts like the cooling down of the hardened, cast medium affecting the tension or giving rise to the cosmic microwave background radiation.

Summary of Bible statements

The key aspects of the fabric of space mentioned in this paper are summarized in table 2.

In terms of understanding the differences between the three words, here is a suggestion:

- The name for skies [*shachaq*] reflects a focus on the *substance*.
- The name for firmament [*raqiya*] reflects a focus on the *process*.
- The name for heavens [Hebrew *shamayim*, from “to be lofty”] reflects a focus on the *placement*.

The heavens occur over 400 times in the Old Testament, so it is by far the most commonly used term out of the three. The heavens are like the finished goods or final product of this manufacturing process.

A scientific theory or model is probably not going to explain all of the statements in table 2, especially as many of them relate to one-off events in the past or in the future. But this summary can give us insight into the structure of the fabric of space and can enable us to put forward theories and models that are *consistent* with the Bible, i.e. models which don’t disagree with the Bible.

The role of a medium in physics has far-reaching effects.² It may even result in a new theory built up from the subquantum level which gives rise to general relativity type

Table 2. Observations from the Bible on the fabric of space

Object	Observation
The skies (Hebrew: <i>shachaq</i>)	The Hebrew word <i>shachaq</i> describes an object or objects which are in the heavens region.
	The <i>shachaq</i> were made firm or hardened by God as part of His creative process (Proverbs 8:28).
	God's strength is in the <i>shachaq</i> (Psalm 68:34).
	The processes of casting and hardening are directly linked to the <i>shachaq</i> (Job 38:37–38; 37:18).
The firmament	There was light on Day 1 before God made the firmament on Day 2.
	The sun, moon, and stars were placed in the “firmament of the heavens” (Genesis 1:14–18). Similarly, the birds fly “across the face of the firmament of the heavens” (Genesis 1:20).
	The Hebrew word <i>raqa</i> (meaning to beat, hammer out, or spread out) is not used to describe the stretching out of the heavens (Isaiah 42:5; 44:24) but the spreading out of the <i>shachaq</i> (Job 37:18). (The Hebrew word for the firmament, <i>raqiya</i> , is related to the verb <i>raqa</i> .)
The heavens	The heavens are stretched out like a curtain and spread out like a tent (Psalm 104:2; Isaiah 40:22).
	The heavens can potentially be torn by God, like tearing a garment (Isaiah 64:1).
	The heavens will wear out like a garment (Psalm 102:26; Hebrews 1:11).
	The heavens will be rolled up like a scroll or robe (Isaiah 34:4; Revelation 6:14; Hebrews 1:12).
	The heavens will be shaken (Hebrews 12:26; Haggai 2:6; Isaiah 13:13) and the “powers of the heavens will be shaken” (Matthew 24:29; Mark 13:25; Luke 21:26).
	The heavens will be changed, like changing clothes, swapping the current version with a new version that can't be shaken (Psalm 102:26; Hebrews 1:12; 12:27).

phenomena, electromagnetism, and the statistical results of quantum mechanics.

Conclusion

The Hebrew word *shachaq* seems to provide a big clue as to the structure of the fabric of space. Unlike the word heavens, it is used with the Hebrew verb *raqa* (to beat, hammer out, or spread out, e.g. metal), which is related to the Hebrew word for the firmament, *raqiya*.

The future rolling up of the heavens strongly suggests there is some dimension in which the heavens are thin. A fabric unfolding in a fourth spatial dimension can appear as if normal three-dimensional space is expanding—see figure 1.

Table 2 summarizes the observations from the Bible mentioned in this paper on the skies, firmament, and the heavens. This list can give us insight into the structure of the fabric of space and provides a biblical filter for evaluating related theories and models.

God's strength is in the *shachaq* (Psalm 68:34)!

References

1. Humphreys, D.R., *Starlight and Time: Solving the puzzle of distant starlight in a young universe*, Master Books, Green Forest, AR, pp. 66–68, 1994.
2. Humphreys, D.R., God's mighty expanse, 2009, creation.com/gods-mighty-expanse.
3. Humphreys, D.R., New view of gravity explains cosmic microwave background radiation, *J. Creation* 28(3):106–114, 2014; creation.com/images/pdfs/tj/j28_3/j28_3_106-114.pdf.

4. Hartnett, J.G., Does the Bible really describe expansion of the universe? *J. Creation* 25(2):125–127, 2011; creation.com/images/pdfs/tj/j25_2/j25_2_125-127.pdf.
5. Taylor, C.V., Waters above or beyond? *J. Creation* (formerly *TJ*) 10(2):211–213, 1996; creation.com/images/pdfs/tj/j10_2/j10_2_211-213.pdf.
6. Humphreys, ref. 1, p. 59–61.
7. Orr, J., General Editor, *The International Standard Bible Encyclopaedia*, vol. 5, The Howard-Severance Company, Chicago, pp. 2947–2948, 1915; www.biblestudytools.com/encyclopedias/isbe/tent.html, accessed 8 August 2015.

Alan Pace received his B.Sc. in physics and mathematics and M.Sc. in theoretical quantum optics, both from the University of Auckland. After graduating, he went on the staff of Campus Crusade for Christ, completing a postgraduate certificate in biblical studies. In recent years he has been working in various roles as an analyst or technical writer. He is currently working on a project to equip people in the church to run evangelistic creation-evolution courses using CMI resources.

The Geography of Genesis 8:4

Bill Crouse

The author of Genesis informs us that the Ark of Noah landed “in the mountains of Ararat”. While this is a general area, it refers to a real location. The key to pinpointing this geographic area is to ask where would the original readers of Genesis have understood it to have been. Geographical and historical studies lead us to conclude that the writer was referring to the mountainous region to the south of Lake Van and north of the historic kingdom of Assyria. It therefore cannot refer to the singular Mt Ararat in north-eastern Turkey as is commonly presumed.

In Genesis 8:4 the Bible not only gives us a precise date for the landing of the Ark but an actual geographic locale for its final berth.¹ Given this attention to detail, it would seem expedient to assume the author wants us to see this event as one occurring in space-time history. In the most important voyage in history, one that transports a remnant of human and animal life from the antediluvian to the post-diluvian world, the author gives a fairly precise location as to where the voyage ended: *the mountains of Ararat*.² Laymen, Ark hunters, and even some scholars and commentators often misinterpret this passage to refer to the singular and spectacular 5,137m peak of this name in northeastern Turkey, near the Armenian and Iranian borders (figure 1). *The plural in the biblical text indicates that a specific mountain is not in view.* The task of the interpreter of this text is to discover the boundaries of the designated mountainous region at the time of the original readers.

In this paper I will attempt to show, through linguistic and geographic studies, that the inspired text is indicating a mountainous region that was historically north of the Kingdom of Assyria in southeastern Turkey, in and around Lake Van.

If Genesis was written by its presumed author, Moses, then it would have to have been composed sometime in the second millennium BC; more specifically, around 1410–1400 BC, just before the Israelites entered Canaan.³ If this is the case, the biblical mention of *Urartu* in this passage is the earliest known mention of this geographical term. About two hundred years later, during the reign of Shalmaneser I (1263–1234 BC), a region of *Uruatri* is mentioned in Assyrian literature, where it almost certainly refers to a geographical region, for it is not until the ninth century BC that Urartu becomes a united kingdom and a regional power.⁴ It is Zimansky’s opinion that *Urartu* is an Assyrian word, as the Urartians never refer to themselves by that designation. He writes:

“Even for the Assyrians who coined the term, ‘Urartu’ had more than one meaning. It was originally a geographical designation of a land that contained several independent political entities. Later it became

the name of a unified state which covered a much larger expanse.”⁵

Piotrovsky also believes that it is an Assyrian word. He believes it “had no ethnic significance but was most probably a descriptive term (perhaps meaning ‘the mountainous country’)”.⁶

In their own literature, they refer to themselves as the *Biainili* and designate their kingdom *Nairi*. Zimansky again argues:

“The mountainous areas north of Assyria were of little consequence to the urban societies in the greater Mesopotamian sphere before the ninth century, except as a source of raw materials such as obsidian, and as the place from which various peoples migrated. Whatever polities existed there in the late second millennium were so inconsequential as to leave few archaeological traces.”⁷

The great linguist A. H. Sayce postulates that

“Urardhu, therefore, contracted into Urdhu, would have been the designation of the highlands of Armenia among the Babylonians as early as the 16th or 17th century BC. Possibly it was then applied only to the mountainous country immediately to the north of Assyria, and was not extended to the districts further north until the Assyrians had become better acquainted with this region, and the native names of its several states.”⁸

Again, assuming Mosaic authorship, could the author, living in Egypt, have known about this region in the middle of the second millennium living about 1,300–1,600 km from Urartu? The answer seems certain that the area was known in Egypt as it was the primary source for the importation of obsidian.⁹ So, unless this passage was redacted or updated by a scribe to reflect a name change¹⁰ later during the time of the Urartian Empire, it is highly unlikely that it could be referring to the area of present-day Mt Ararat / Agri Dag, a post-Flood volcanic mountain that stands out by itself on the Araxis Plain.¹¹ Therefore, to make *the mountains of Ararat* of Genesis 8:4 refer to the boundaries of the greater Kingdom of Urartu at the time of the composition of Genesis is unwarranted. On the other hand, the mountainous area



Figure 1. Mt Ararat (5,137 m), in Northeastern Turkey, looking south

south of Lake Van was notorious in antiquity because it acted as a formidable barrier between Assyria and the regions to the north. It was this area that Xenophon and the retreating Greeks found so difficult to traverse during the *anabasis* at the beginning of the fourth century (figure 2).¹²

Sayce goes on to say:

“However, this may be, it is plain that Bitanu was the name given by the Assyrians to the country which stretched away from the southern shore of Lake Van to Diarbekir and the eastern bank of the Euphrates, and when Assur-natsir-pal makes it synonymous with Urardhu, it is of the southern part of Urardhu that he is thinking.”¹³

To summarize this point: it does not appear that the writer of Genesis was referring to a *country* or a *state* of Urartu since it did not exist when Genesis was written. The weight of the evidence seems to indicate that the term was referring to a geographical area only.

The term *Urartu* appears three more times in the Old Testament and once in the Apocrypha. In three of these passages, a state could possibly be in view because the later date of composition allows it to be so. II Kings 19:37; Isaiah 37:38; and Tobit 1:21 chronicle the same event: the assassination of Sennacherib by his two sons. After the patricide these sources inform us they fled to *the land* (ארצ) of *Urartu*, a fitting place of refuge as it was an enemy country (state) to their native Assyria. According to Jewish tradition, these two sons of Sennacherib lived out their lives in the city of Jazri (now the city of Cizre), a city with a large population of Jews from northern Israel who had been previously deported by Tiglath Pileser III, and Shalmaneser V.¹⁴ Ginzberg notes that two “famous scholars Shemiah and Abtalion were descendants of these two sons of Sennacherib.”¹⁵ In the other passage, in Jeremiah 51:27, the

prophet is challenging three kingdoms, Ararat/Urartu, Minni, and Ashkenaz, to form a coalition to fight against Babylon. It is obvious here that a kingdom is in view (figure 3).¹⁶

In the Tobit (1:21) passage, the writer reiterates the same account of Sennacherib’s assassination by his two sons, but he uses the same wording as Genesis 8:4: *the mountains of Urartu* instead of *the land of Urartu* as in Isaiah and II Kings. One would have expected the latter, since by this time Urartu had become a formidable empire. We speculate that he uses *mountains* because, as noted above, it was notorious in antiquity as a place to flee to if you didn’t want to be found!

The Aramaic targums

The targums were interpretive translations of the OT Hebrew in Aramaic that were made for the Jews after they returned from the captivity in Babylon (see Nehemiah 8:8). After their long captivity many of the Jews forgot their native tongue (Hebrew) and only understood the language (Aramaic) of their former captors. These translations were originally oral and were almost like paraphrases, and, in some instances, were like running commentaries. These targums later attained a fixed form around the first century AD and were written down and preserved.¹⁷ They give Bible scholars a valuable tool for textual criticism and interpretation. One of these targums, Onkelos, puts the landing place of the Ark in the Qardu (Kurdish) mountains (see figure 4). Two others, Neofiti and pseudo-Jonathan, put the Ark in *Qardon*, presumably a variant spelling. It should be remembered that some of the Israelites from the Northern Kingdom were taken by their captors to these very mountains as well as in the vicinity north of Mesopotamia. They probably did not know of the kingdom of Urartu/Ararat since that kingdom had



Figure 2. This satellite photo approximates the territory of the rugged mountainous region of Urartu at the time of Moses (Google Earth 2006)

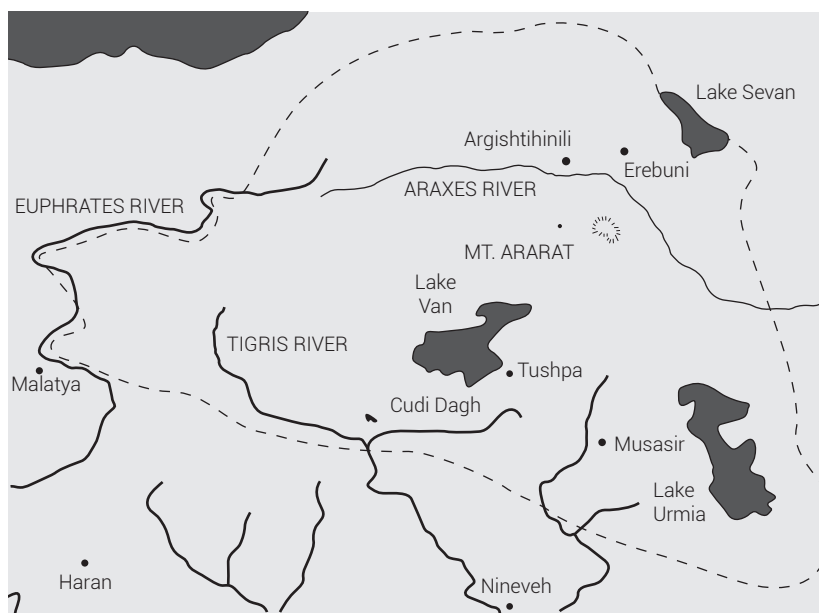


Figure 3. Map shows the fullest extent of the Urtian Kingdom (after Yamauchi¹⁶)

ceased to exist centuries earlier, around the seventh century BC. In addition, in Isaiah 37:38 these targums also update the place that the sons of Sennacherib escaped to: *the mountains of Kardû*. Several centuries later, an entire translation of the Hebrew OT was made into Syriac (an Aramaic dialect).¹⁸ It follows the Aramaic tradition and updates *Uratu* to *Qardu*.

The Pseudepigrapha

The *Pseudepigrapha* are non-canonical Jewish literature from about 200 BC to AD 200.¹⁹ They are important second-temple texts, and the word refers to certain writings purported to have come from biblical characters, and refers to books of ancient Jewish literature outside the canon. Portions and fragments of this material were found in Qumran, and several books are quoted in the New Testament. This body of literature is notorious for the details it adds to the Flood story. The book of *Jubilees*, known as *little Genesis*, has been dated as early as the second century BC and was undoubtedly originally written in Hebrew.²⁰ It has the Ark landing on *Lubar*, one of the mountains of *Ararat*.²¹ It also notes that Noah planted a vine on this mountain and each of his sons built cities there, naming them after their wives.²² The mystery is the location of this mountain named *Lubar*. It seems to originate with *Jubilees*. Christian writers, including Epiphanius, along with Midrashic literature, copy this tradition. Cassuto thinks that the possibility ought to be considered that *Lubar* is identical to *Baris* (βᾱρις) in the Nicholas of Damascus account.²³ Sayce is more certain that they are one and the same.²⁴ *The Genesis Apocryphon*, another book

from this same body of literature, shows a great deal of similarity to *Jubilees* but is fragmentary at a crucial spot. It mentions that Noah planted a vine and was buried on Mt Lubar. The assumption is that it also would have the Ark landing on the same Mt Lubar.

“The Sibylline Oracles has the Ark landing on a certain tall lofty mountain on the dark mainland of Phrygia. It is called Ararat. When all were about to be saved on it, thereupon there was a great heartfelt longing. There the springs of the great river Marsyos had sprung up. In this place the Ark remained on lofty summits when the waters had subsided.”²⁵

The reference to Phrygia is certainly problematic for the view being presented here. There are so many unknowns.

Interestingly enough, Julius Africanus, a Christian writer of the second and third centuries, may have been influenced by the Sibylline Oracles. He notes that “the Ark settled on the mountains of Ararat, which we know to be in Parthia; but some say that they are at Celanene of Phrygia”.²⁶ He gives the view he knows to be true, but wants his readers to know that there is another opinion out there. Indeed, in the second and third centuries, the mountains of Ararat, that range of mountains just north of the old kingdom of Assyria,



Figure 4. Map shows the location of ancient Kurdistan and how it overlaps the Urtian Mountains. Note the variant in spelling Gordyene.

were under Parthian rule; it would have been proper to say that the Ark landed in Parthia at that time. The author has personally visited this area and has seen the archaeological evidence of the previous Parthian dominance.²⁷

Josephus

Josephus, the important first century Jewish historian, mentions the landing site of Noah's Ark on five different occasions.²⁸ In his first mention of the Ark, what is first noticeable is that he updates the *Urartu* of Genesis 8:4 with *Armenia*.²⁹ He also makes the landing place very specific as being *in Armenia on a Kurdish mountain* (note singular).³⁰ Josephus was a very learned man in his day and, as we know, he had access to some of the great libraries that existed in the Near East at that time. In his account of the Flood, he was obviously acquainted with the biblical account, but he also quotes a number of what he calls *barbarian* or *pagan* sources (βαρβαρικάς).³¹ On his second mention of the Ark, he quotes Berossus, a Babylonian high priest of Bel, who wrote a history of the world in Greek in the early third century BC. His work, *Babyloniaca*, has only survived as it has been quoted from several sources, the most important of these being the late first century writer Polyhistor.³² While Berossus wrote his history in Greek, the *lingua franca* of his time, there is evidence that he was also competent in reading the cuneiform of both Akkadian and Sumerian.³³ His account of the Flood draws heavily on the Babylonian flood account, as one would expect. In the important quote about the Ark, he says that

"A portion of the ship which came to rest in Armenia still remains in the mountains of the Korduaian of Armenia, and some of the people, scraping off pieces of bitumen from the ship, bring them back and use them as talismans."³⁴

It is obvious that Berossus, when he wrote about the Flood, had a copy of the Babylonian flood story before him. His account contains all of the pagan elements, and the hero of the story is Xisuthros (Ziusudra) as in the Babylonian tradition. What I find fascinating is that though the Babylonian flood account clearly states that the Ark's landing place was on *Mt Nimush* (formerly written as *Niser*), Berossus, in his account, has the Ark landing on *the mountains of the Cordyaeans, in Armenia*, which is more in agreement with the Hebrew sources! This *Mt Nimus* has been positively identified by Speiser as the *Pir Omar Gudrun* in the Zagros Mountains in present-day Iraq, close to the border of Iran.³⁵

It can truthfully be said that *Pir Omar Gudrun* is a mountain in Kurdistan, but it cannot be said that it is a Kurdish mountain in Armenia, since historic Armenia never extended that far southeast. The question we must then ask is why? Why does Berossus change what he sees written on his clay tablets? Is it because he is a historian and he is trying to correct what he knows to be true from other sources? We can

only speculate. Urartu, at the time that this document was written, had ceased to exist, being replaced by the Kingdom of Armenia. Consequently, we can exclude Mt Ararat as a possibility from this Berossus/Josephus quote because, during this time period (Berossus to Josephus), the Kurdish people did not live there (at Mt Ararat). It was not until the 10th and 11th centuries AD that the Kurdish people migrated there from the northern parts of Mesopotamia.³⁶

Some believe that Josephus was hopelessly contradictory about his account of the Flood and the landing place of the Ark.³⁷ For example, in his third mention of the Ark, he quotes Nicholas of Damascus, a first century historian and philosopher, who was a consort of Herod the Great, Herod Archelaus, and was the tutor of the children of Anthony and Cleopatra. His history of Assyria has largely been discounted by Assyriologists as totally unreliable.³⁸ Josephus quotes him several times in his works, and where he quotes him about the Flood and the landing place of the Ark, we are presented with some problems. First, Nicholas obviously does not believe in a universal Flood, as he has a large number of people surviving the Flood on a large or great (μεγά) mountain, presumably the same mountain where the Ark landed. Secondly, he gives a name for this mountain we do not encounter anywhere else in literature. According to Nicholas, the Ark landed on a mountain in Armenia named *Baris* (noted earlier):

"There is above the country of Minyas in Armenia a great mountain called Baris, where, as the story goes, many refugees found safety at the time of the flood, and one man, transported upon an ark, grounded upon the summit, and relics of the timber were for long preserved ..."³⁹

Where does Nicholas obtain this variant of the Flood story about survivors outside of the Ark? At present we do not know his source. Likewise, where does he come up with the name *Baris* for the name of the mountain? So far in the extant literature this is unique to Nicholas. Both Cassuto and Sayce believe *Baris* is just a variant of *Lubar*. We agree that their suggestion is a good one, but it just lacks certainty. Nicholas puts the Ark's landing on a *great* (μεγά) mountain above the country of Minyas in Armenia. Minyas, we know, is one of the three kingdoms mentioned in Jeremiah 51 and is usually believed to be located south of Lake Urmia in what is now Iran. It is certainly possible that Nicholas here may have the 5,137 m Mt Ararat in mind, or he may just be in error. Since Minyas is not that distant from the Ararat Mountains, he may be in the ballpark so to speak. It was entirely normal for geographers in antiquity who had never visited the actual site to be a little off on the boundaries.³⁶

Another consideration here is how to translate the Greek word *ὑπερ* *owpere*. It can also be translated *beyond*, *about*, or *over*. This could presumably make Mt Ararat less certain, as the Ark's final resting place. Mt Ararat lies to the north and slightly to the west of Minyas. It is also interesting that

he speaks *in the past tense* about the Ark's existence, while Josephus, in his other quote, seems to indicate remains in his day.

On his fourth mention of the Ark's landing place, Josephus puts it in a country called *Carrown* (Καρρων), which was in the kingdom of Adiabene. Scholars of the original text of Josephus believe the *Carrown* here is a corruption and should read *Kardu* (Καρδύ). If we assume that he was reading some Hebrew text about the kingdom of Adiabene, it would have been very easy to confuse the Hebrew letters *daleth* (ד) and *resh* (ר). Note how easy it would have been to be confused: English: *Kardu-Carron*; Greek: Καρδύ-Καρρων; Hebrew: קררן – קררו. The kingdom of Adiabene was concentrated to the southeast of the mountains of Urartu with a centre in Arbela (present-day Irbil in Iraq (see figure 4). As is well known, borders in antiquity were not precise. Since it is a known fact that Jews populated the Cizre plain in the first century, it is highly likely that the kingdom of Adiabene did extend that far northwest. We know that it included Nisibis, which is even further west.⁴⁰ It also totally rules out Mt Ararat as a possibility. Josephus here adds a little caveat that the Ark landed in a land where much amomum grows. This is apparently a plant from which a spice is derived that is known elsewhere in classical literature as *cardamum* and in Latin as *cardamomum*.⁴¹ It was native to Media and grows in mountainous areas.

In the fifth reference, Josephus has the Ark landing on *the highest mountain in Armenia* according to Whiston's translation. Again, as it stands, this could very well be a reference to the 5,137 m Mt Ararat. The Kingdom of Armenia by this time did indeed include that northern area. However, it is far from certain that he had that mountain in mind. Why? Because of translation ambiguity. Thackeray translated this passage: *it landed on the heights of the mountains of Armenia* (ταῖς ἀκρωτείσαις τῶν Ἀρμενίων ὀρέων).⁴² This is a big difference, and it would again make it an undesignated mountain.

The problem of Genesis 11:1–2

Given the above interpretation of Genesis 8:4 that "Ararat" is a mountainous area above historic Assyria, is there a conflict with Genesis 11:1–2? It states: "*And the whole earth was of one language, and of one speech. And it came to pass, as they journeyed from the east, that they found a plain in the land of Shinar; and they dwelt there*" (KJV). The argument goes like this: if you translate the Hebrew: מִקְּדֵם *miqqedem* as *from the east*, as the KJV does, it would clearly seem to indicate that the Ark must have landed somewhere to the east of historic Shinar (Mesopotamia) in modern-day Iran since it is that country that is directly east of Shinar. However, if you translate the *miqqedem* as *eastward*, as the NIV does, then you have the migration coming from the west toward

Shinar. Elsewhere *miqqedem* is translated *in the east* (NEB), that is: men moved in the east; then, the directional point is much more indefinite.

Given that this migration occurred several hundred years after the disembarking from the Ark from the previous context of chapter 10, it seems best not to push this passage too much. Wenham favours *in the east* when the *miqqedem* is used adverbially, as in 2:8; 12:8; and Isaiah 9:12.⁴³ In addition, Matthews believes *miqqedem* marks events of separation, so it can also have a metaphorical sense.⁴⁴ Russell Humphreys, for example, follows a more specific and directional interpretation as in the KJV. He then concludes that the Ark had to have landed somewhere east of Shinar (Sumer) as in the Zagros Mountains, which constitute the border between present-day Iraq and Iran.⁴⁵ Relic hunter and explorer Robert Cornuke does likewise, but he has the Ark landing in far northern Iran in the Elburz Mountains.⁴⁶ The problem with both of these designations for the Ark's final resting place is that they are both considerably out of the biblical mountains of Ararat as we argued above. In Cornuke's case, the Elburz Mountains are far to the northeast of the plain of Shinar, and there is no indication from ancient sources that the kingdom of Ararat/Urartu ever extended that far northeast, even at the height of its power.

The apparent conflict between 8:4 and 11:1, 2 is more easily resolved with a more indefinite interpretation in my opinion. It should also be pointed out that there is least a 100–300-year period between the landing of the Ark after the Flood (Genesis 8) and the Tower of Babel event (Genesis 11). The peoples could have easily moved from where the Ark landed to other locations east or west of Shinar [Babylonia] before the Tower of Babel event took place.⁴⁷

Conclusion

The geographical and historical evidence strongly suggests that Noah's Ark landed in southeastern Turkey (south of Lake Van) and not in the vicinity of Mt Ararat in the northeast as is commonly believed. Why then is most of the current interest and exploration centered on this mountain? I believe there are several reasons:

Since the mid-20th century there have been dozens of claimed sightings of Noah's Ark. The explorers then argue that 'where there is smoke there must be fire'.⁴⁸

Since Mt Ararat (Agri Dag) is the highest mountain in Turkey, at 5,137 m, the assumption is easily (but mistakenly, I believe) made that the Ark must have landed there.

Tantalizing objects have been photographed; some from aircraft and some from satellites. On a volcanic mountain like Ararat they have in most cases been identified as large blocks of basalt.⁴⁹

Most of the Ark researchers assume that Mt Ararat is a good candidate because the Kingdom of Ararat/Urartu did



Figure 5. This mountain, known as Cudi Dag, is the southern boundary of the Mountains of Ararat. The landing place is alleged to be approximately in the middle of the photo. (From Timo Roller.)

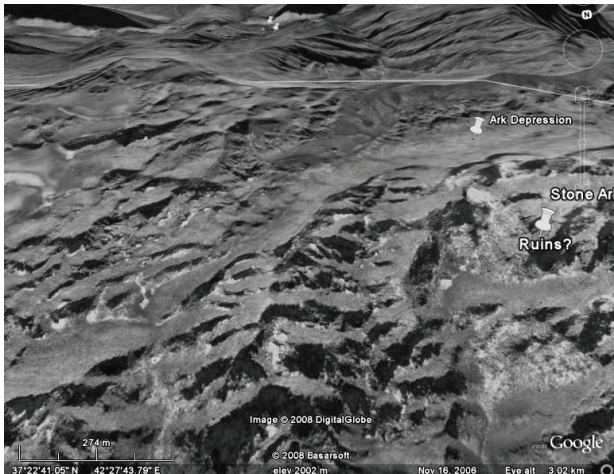


Figure 6. The landing place on Cudi Dag as seen from Google Earth. Note the depression where the Ark may have rested.

encompass that mountain and even extend farther north into present-day Armenia. That fact is true, but it fails to take into consideration the location of Ararat as understood by the first readers of Genesis.

Finally, most of the contemporary searchers still continue the search on Ararat because of a refusal to give up the hope that the biblical artifact will be found intact, as many eyewitnesses have claimed; hence, the quest continues. The possibility that Noah's Ark could be found intact and witnessed by the world dies hard.

In this research paper I have assumed the full authority of Scripture that there was a literal Flood and a literal Ark and that the ship landed in a literal place according to the clue from Genesis 8:4. With the evidence given above, I

believe we can know the general area of its final berth: the mountainous region south of Lake Van and east of the Euphrates River.

The question then is: is there any historical evidence or tradition about a specific site? I believe there is. I enumerated some of these sources in my 2001 article.⁵⁰ The site we have in mind today is called *Cudi Dag*.⁵¹ It has strong tradition among several religions. It is my opinion that pagan historians, early Armenian accounts, Jewish literature, the Syriac Church, and Islamic historians support this mountain. We also predict that some great and exciting discoveries await this area in future excavations.⁵² To our knowledge, no major excavations have been done or are occurring in this area on the southern end of the

Uratian Mountains. Surveys have been done, however, that indicate that the area shows great possibilities for future archaeological excavations (see figures 5 and 6).^{53,54}

References

1. Tishri 17 corresponds roughly to our Sept-Oct. It was the most sacred month in the Jewish calendar as it included the Day of Atonement. This would seem fitting to the typology and theology of the Flood and the Ark. See: Matthews, K.A., *The New American Commentary: Genesis 1–11:26*, Broadman and Holman, Nashville, TN, p. 385, 1996.
2. The precise date given in this verse and in verse 5 for this event makes us want to take the landing place in the same vein.
3. For a discussion about the date that Genesis was written see: Youngblood, R.F., *The Book of Genesis*, 2nd edn, Baker Book House, Grand Rapids, MI, p. 14ff, 1991.
4. Zimansky, P.E., *Ecology and Empire: The Structure of the Urartian State*, The Oriental Institute, Chicago, IL, p. 4, 1982.
5. Zimansky, ref. 4, p. 9.
6. Piotrovsky, B.B., *The Ancient Civilization of Urartu*, trans. James Hogarth, Cowles Book Company, NY, p. 43, 1969.
7. Zimansky, P.E., The Kingdom of Urartu in Eastern Anatolia, in *Civilizations of the Ancient Near East* vol. II., Sasson, J.M. (Ed.), Charles Scribner's Sons, NY, p. 1136, 1995.
8. Sayce, A.H., The Cuneiform Inscriptions of Van, Deciphered and Translated, in *J. Royal Asiatic Society of Great Britain and Ireland* vol. 14, Trubner and Co, London, p. 392, 1882.
9. Burney, C. and Lang, D.M., *The Peoples of the Hills*, Praeger Publishers, New York, p. 16, 1971.
10. That there was an editor who made changes after Moses's death is agreed upon. However, in this case, assuming a scribe updated a place name to 'Urartu', what would have been the previous toponym?
11. For the evidence that Mt. Ararat is a post-flood volcano see: Habermehl, A., *The Role of Science in Determining the Resting Place of the Ark*, www.creationsixdays.net/role_of_science_in_determini.htm, accessed 7 January 2016. The evidence seems to indicate that Mt. Ararat, a stratovolcano, sits on a bedrock of sedimentary limestone laid down during the Flood.
12. See: Prevas, J., *Xenophon's March: Into The Lair Of The Persian Lion*, Da Capo Press, Cambridge, MA, 2002.
13. Sayce, A.H., The Cuneiform Inscriptions of Van, *J. Royal Asiatic Society of Great Britain and Ireland*, Cambridge University Press, p. 396, 1882.

14. See: Neusner, J., The Jews in Pagan Armenia, *J. American Oriental Society* 84(3):230–240, 1964.
15. Ginzberg, L., *The Legends of the Jews*, The Jewish Publication Society of America, Philadelphia, PA, p. 270, 1913.
16. Yamauchi, E.M., *Foes from the Northern Frontier*, Grand Rapids, MI, p. 32, 1982.
17. Bruce, F.F., *The Books and the Parchments*, revised edn, Fleming Revell, Old Tappan, NJ, p. 134, 1963.
18. This Syriac version is known as the *Peshitto* or *Peshitta*.
19. There is some definite Christian influence in the texts of later date.
20. Charlesworth, J.H. (Ed.), *The Old Testament Pseudepigrapha*, vol. 2, Doubleday, New York, pp. 43–44, 1985.
21. *Jubilees* 5:29; 7:1, in Charlesworth, ref. 20, p. 66, 68.
22. *Jubilees* 7:17, in Charlesworth, ref. 20, p. 69.
23. Cassuto, U., *A Commentary on The Book of Genesis*, part 1, The Magnes Press, Jerusalem, p. 105, 1964.
24. Sayce, ref. 8, p. 389.
25. Sibylline Oracles 1:261–266, in Charlesworth, ref. 20, p. 341.
26. Africanus, J., *Fragments of the Chronology*, IV; Bailey believes the Phrygia reference comes from the influence of Greek Flood Stories. See: Bailey, L.R., *Noah: The Person And The Story In History And Tradition*, University of South Carolina Press, SC, p. 68, 1989.
27. I am referring to a rock carving in Kasrik Canyon just a little east of Cudi Dag. Algaze identifies it as Parthian. See: Algaze, G., A New Frontier: First Results of the Tigris-Euphrates Archaeological Reconnaissance Project, 1988, *J. Near Eastern Studies* 48(4):250, 1989.
28. Whiston, W., trans. *Antiquities*, I:90–92; I:93–94; I:95; 20:24–25; *Against Apion* I:130.
29. Josephus, who is probably reading the Greek text (LXX), knows that the Kingdom of Urartu has ceased to exist over 400 years ago, so for his readers' sake, he updates it to Armenia.
30. *Antiquities*, I:5, 90.
31. Josephus says that others who corroborate Berossus's testimony are: Hieronymus the Egyptian, Mnaseas, Nicholas of Damascus, and 'many others', *Antiquities*, I:94.
32. Many of the people who quote Berossus did not have an original copy either, but quote sources which themselves are no longer extant. For example, Eusebius quotes from Polyhistor, whose writings are lost. See also: Burstein, S.M., *The Babyloniaca of Bersossus*, Udena Publications, p. 21, 1978. This Burstein work represents the most complete effort to restore *The Babyloniaca*.
33. Kormoroczy, G., Bersossus and The Mesopotamian Literature, *Acta Antiqua* (Akademiai Kiado, Budapest, Hungary) XXI:127–128, 1973.
34. This quote is from Polyhistor, but when Josephus quotes Berossus, he makes a subtle change: he switches to the singular "mountain of the Korduaian." Whether this was a mistake or he is narrowing it down is just conjecture.
35. Speiser, E.A., Southern Kurdistan in the Annals of Ashurnasipal and Today, *Annual of the American Schools of Oriental Research* (New Haven, CT) VII:18, 1928.
36. Haroutyunian, S., Armenian Epic Tradition and Kurdish Folklore, *Iran & the Caucasus*, p. 88, 1997.
37. Bailey, ref. 26, p. 66.
38. Drews, R., Sargon; Cyrus and Mesopotamian Folk History, *J. Near Eastern Studies* 33(4):387–393, 1974.
39. *Antiquities*, I:94–98. The big question mark here is how to translate the 'owpere'. It can certainly be translated 'above', but it can also be translated 'beyond', 'about', or 'over'.
40. Pliny, *Natural History*, 6:16.
41. Dalby, A., *Dangerous Tastes*, University of California Press, CA, p. 102ff, 2000. See also: Pliny, ref. 40, 49ff.
42. Josephus, *Josephus in Nine Volumes*, trans. Thackeray, H.StJ., Harvard University Press, MCMLXXVI, pp. 214–15.
43. Wenham, G.J., *Word Biblical Commentary: Genesis 1–15*, Word Books, Waco, TX, p. 238, 1991.
44. Matthews, K.A., *The New American Commentary: Genesis 1–11:26*, Broadman and Holman, Nashville, TN, p. 478, 1996.
45. Humphreys, R., Where is Noah's Ark: A closer look at the biblical clues, *J. Creation* 26(2):3, 2011.
46. Franz, G., *Did the BASE Institute Find Noah's Ark in Iran*, www.lifeandland.org/2009/04/did-the-base-institute-discover-noah%E2%80%99s-ark-in-iran/, accessed 7 January 2016.
47. Here I am assuming the current consensus of opinion that Shinar is in southern Mesopotamia. Anne Habermehl makes the case for Shinar being in the upper Khabur River triangle. Her site is almost directly west of Cudi Dag, a traditional landing place of the Ark at the southern tip of the Urartian Mountains. If her conclusion proves to be correct someday, then the KJV translation *from the east* easily resolves the difficulty. See: *Where in the World is the Tower of Babel?* answersingenesis.org/tower-of-babel/where-in-the-world-is-the-tower-of-babel/, 2011.
48. Despite all the alleged sightings none have ever proven fruitful in the quest. Most are seriously suspect, and hopelessly contradictory.
49. See my article: *Phantom Arks on Ararat*, 1990, www.christianinformation.org/Feb1990AraratReport.pdf, accessed 7 January 2016.
50. Crouse, B., The Landing Place, *J. Creation* 15(3):10–18, 2001.
51. The name the Assyrians give to this mountain is 'Nippur'. See the paper of Franz, G., *Did Sennacherib Worship Wood from Noah's Ark?* 2013, www.lifeandland.org/2013/10/did-sennacherib-king-of-assyria-worship-wood-from-noah%E2%80%99s-ark-as-a-deity/, accessed 7 January 2016.
52. No scientific research has been possible for the last several decades due to the political and military situation in that region.
53. Parker, B.J., The Northern Frontier of Assyria: An Archaeological Perspective; in: Parpola, S. and Whiting, R.M. (Eds.), *Proceedings of the 10th Anniversary Symposium of the Neo-Assyrian Text Corpus Project*, Helsinki, 1997.
54. Algaze, G., A New frontier: first results of the Tigris-Euphrates Archaeological Reconnaissance Project, *J. Near Eastern Studies* 48(4), 1989.

Bill Crouse holds degrees in psychology from Goshen College, theology from Dallas Theological Seminary, with advanced work in philosophy and history at The University of Texas at Dallas. He is the founder and President of Christian Information Ministries; and is also founder and past editor of The Ararat Report, a newsletter offering the Christian community an insight into the search for Noah's Ark. Bill has published in World Magazine, Archaeology and Biblical Research (now The Bible and the Spade), Moody Monthly and a host of other publications and newsletters. He has led a team of explorers in search for the Ark and is considered to be one of the world's foremost scholars in Ark studies. Recently, he contributed to the publication, *The Explorers of Ararat*, edited by B.J. Corbin.

The Cenozoic, Flood processes, and post-Flood catastrophism—problems and parameters

Michael J. Oard

An integral part of any comprehensive Flood model is discerning the distinction between Flood processes and post-Flood catastrophism in the rock record. The characteristics of the continental shelf, slope, and rise suggest that the location of the boundary was reasonably synchronous on a global scale. However, there is no consensus among Flood geologists on where the post-Flood boundary should be placed. The geological column concept provides a useful framework of discourse for examining different approaches to the post-Flood boundary among creationists. There are three main schools of thought: (1) the Precambrian/Paleozoic Boundary Model, (2) the K/T Boundary Model, and (3) the Late Cenozoic Boundary Model. Each one makes different assumptions and has specific issues that need addressing. Multiple criteria spanning several fields of study need to be used to examine this issue since just one can be equivocal.

The development of a sophisticated Flood model is important to creation scientists and Christians alike. A model that is capable of integrating geology, geophysics, paleontology, and geomorphology into a coherent description of the global Flood would have great apologetic value. An integral part of such a project is understanding the nature, scope, and intensity of Flood and post-Flood processes reflected in the rock record. Distinctions that can be discerned between Flood and post-Flood phenomena will aid us in determining the location of the Flood/post-Flood boundary.

The Flood/post-Flood boundary can be defined as a horizontal line in a vertical sequence of rock and sediments below which rocks were deposited during the Flood, and above which rocks and sediments have been deposited after the Flood. Placement affects many details of a Flood model, especially the late Flood period. Our understanding of where the post-Flood boundary is located is affected by how we understand the distinction between Flood and post-Flood processes. It also reflects how we understand the extent and intensity of post-Flood catastrophism because we need to explain the rocks, fossils, and sediment above the boundary as deposited by post-Flood processes. Baraminology is affected as well, since it determines the degree of post-Flood animal and plant diversification.^{1,2} Unfortunately, within Flood geology, the scope and intensity of post-Flood catastrophism, the relation between Flood and post-Flood processes, and hence the location of the Flood/post-Flood boundary are all still very controversial.

Is there a boundary?

Some may ask: “Is there a discernible boundary?” Did the Flood end before Day 371 in some places but continue on for some time, possibly many years, in other places? Or was the Flood complete on Day 371 everywhere on Earth? Either way,

there has to be a boundary at numerous locations,³ whether it is synchronous or not. Nonetheless, unique features of the continental margins suggest the latter.

The uniqueness of the continental margin

Although few uniformitarian scientists address this issue, the continental shelf and slope are unique geomorphological features that are difficult for them to explain. The continental shelf is a seaward extension of the continent, or coastal plain, from the shoreline to the shelf break or shelf edge. The shelf edge is the seaward terminus of the continental shelf and the beginning of the continental slope. The continental shelf dips very gently seaward at less than 0.1°, with a subdued relief of less than 20 m. The seaward width of continental shelves varies considerably from several km to more than 400 km, the average being 80 km. At least one shelf is over 1,000 km wide.⁴ The widest shelves are found along the Arctic Ocean. The Bering Sea, Grand Banks, and Newfoundland shelves are also very wide. The continental slope is a sharp ‘drop-off’ down to abyssal depths. The sedimentary rocks that make up the continental margin are often very thick, reaching over 15 km, and show a seaward thickening wedge of slightly dipping sediment rocks (figure 1). The margin is like a *continuous sheet* of strata around all continents and large islands.

King described the problem of the origin of the continental margin:

“There arises, however, the question as to what marine agency was responsible for the leveling of the shelf in early Cenozoic time, a leveling that was preserved, with minor modification, until the offshore canyon cutting of Quaternary time? Briefly *the shelf is too wide, and towards the outer edge too deep*, to have been controlled by normal wind-generated waves of the ocean surface [emphasis added].”⁵

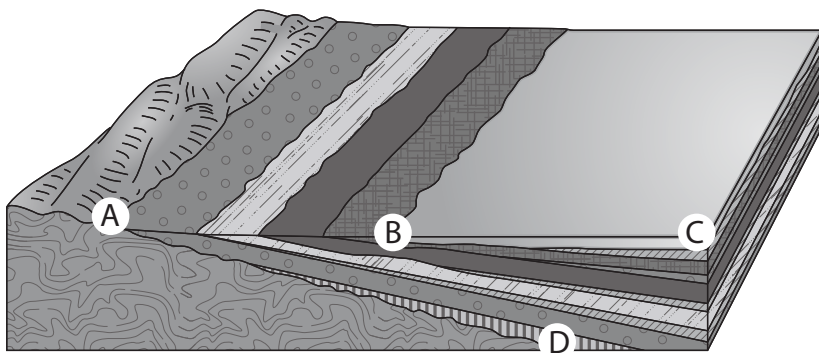


Figure 1. The seaward thickening wedge of sedimentary rock (drawn by Mrs Melanie Richard)

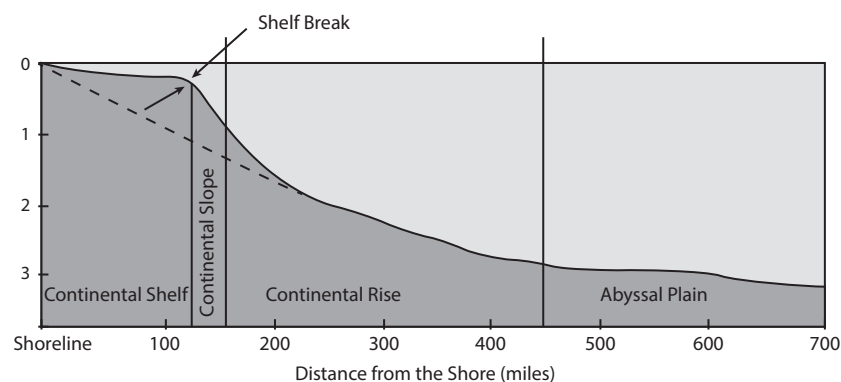


Figure 2. Principal features of an Atlantic-type margin with a vertical exaggeration of about 1/50 (drawn by Mrs Melanie Richard). Note the dashed line, which represents the slope that should occur after millions of years of the action of normal wind-driven currents in the ocean today.

When King wrote, it was widely believed submarine canyons were of Quaternary age, but now they are believed to be much older. It would seem that natural processes, such as shore parallel currents and mass wasting, would favour a gradual descent of the slope to the ocean depths. Figure 2 contrasts the shape of the continental margin today versus what seems more likely under actualistic conditions.

Continental margins formed by Flood runoff

The continental margins represent massive, widespread deposition over a huge area. It is logical to conclude that the margin sediments came from the continents. Their shape and form indicate sediment-filled, continent-wide Flood currents once rushed into the deepening ocean.⁶ Continental slopes likely signify the edge of this sheet flow deposition. This deposition would be analogous to the formation of a river delta; the top of the delta

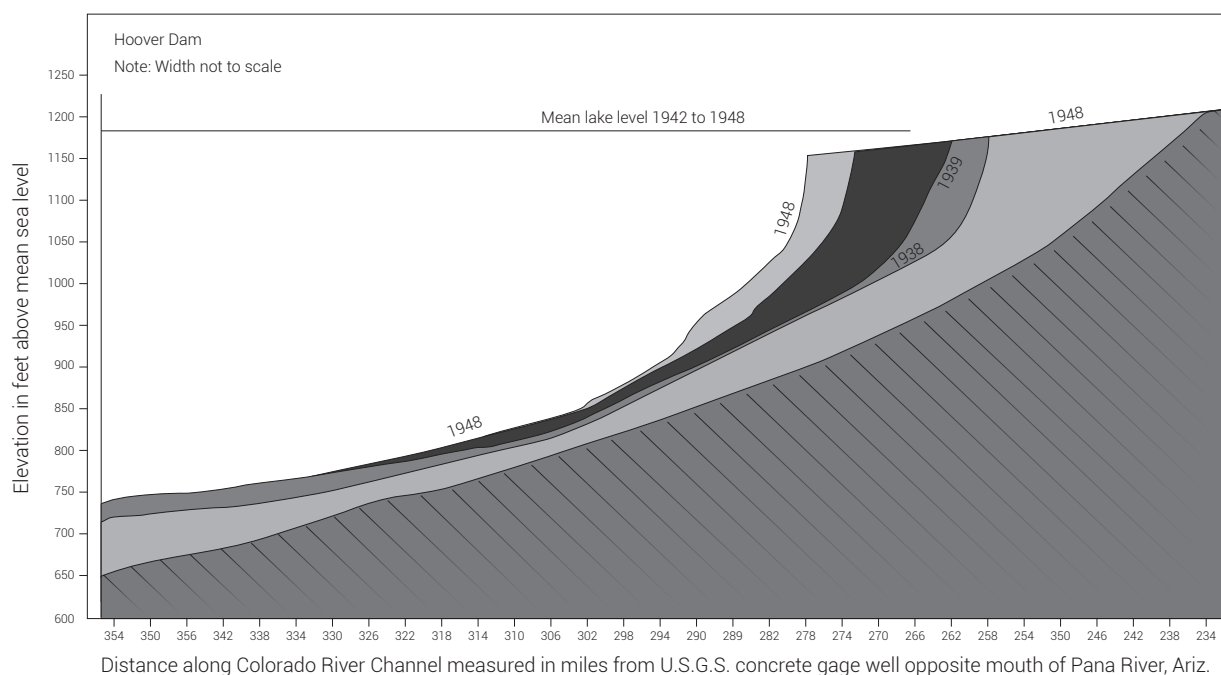


Figure 3. The yearly prograding Colorado River delta into Lake Mead in the Lower Granite Gorge from 1938 to 1948 (drawn by Mrs Melanie Richard; from Kostic et al.)

resembles the continental shelf and the edge of the delta the continental slope. The analogy breaks down, since most deltas can spread parallel to the shore.

However, a case where the delta could not move parallel to the shore is found in the recently formed delta of the Colorado River.⁷ It formed as Lake Mead filled with water and the Colorado River met with Lake Mead in the narrow Lower Granite Gorge (figure 3). There were no currents along the shore to spread the sediments since they were deposited in a narrow gorge. As such, deposition developed parallel to the flow of the river. Figure 3 shows the top of the delta is nearly flat with a slight lakeward slope until it reaches a steep drop-off. If the Colorado River delta feature is comparable to the continental shelf and slope, this example gives an illustration of how the continental shelf and slope would likely have formed when wide Flood sheet currents flowed off the rising continents.

The top of the continental slope is generally at a *consistent depth* of 130 m off all continents, except Antarctica where there has been isostatic depression by the massive ice sheet.⁸ If the Flood continued for many more years on some continents and not others, this shelf break would not have a similar depth. Instead it would be at variable depths due to variable offshore flow and vertical tectonics. It takes *energy* to erode and transport sediment to the margin. This would have to be supplied by continuing tectonics. The similar depth implies the tectonics and energy sustaining the Flood stopped at about the same time everywhere on Earth. If one continent continued to rise slowly for e.g. 100 years after the Flood, it would then have only weak currents with weak tectonics and form small continental margin sediments at different water depths (figure 4). In that situation shore-parallel deposition would be more likely. A chaos of small delta-like features should be found along the continental margin.

Considering the geomorphology of the continental margin, it appears the Flood and differential vertical tectonics ended everywhere by Day 371 (there could of course have been very minor tectonics at the margins). It appears the Flood did not stop in one part of the world and continue on in other parts.

The geological column as a tentative reference system

Communicating the location of the post-Flood boundary is an important part of the task of assessing different conceptions of post-Flood catastrophism. Uniformitarian scientists have developed a global sequence of events called the geological column but can this geological column be used as a first approximation for the sake of discussion? The geological column is another controversial issue within creation science.⁹ Some creationists believe the geological column is an absolute sequence of biblical earth history,

Table 1. The three main schools of thought for the location of the Flood/post-Flood boundary assuming the geological column

Model
The Precambrian/Paleozoic Boundary Model
The K/T Boundary Model
The Late Cenozoic Boundary Model

while others believe we should discard it entirely, and some, like myself, take a middle position that the geological column represents a general order with time with many exceptions.^{10–12} The geological column would then represent a Flood depositional order. Ecological zonation would be one major ordering variable.

Nonetheless, these different views are focused on the usefulness of the geological column *for describing the empirical rock record*, not its usefulness *as an established convention of geological discourse*. And since the geological column is an established framework of geological discourse, it serves as a useful way to communicate the location of the post-Flood boundary across ideological lines. If there is a globally synchronous post-Flood boundary identifiable with some level in the geological column, then it would obviously make sense to use the geological column to communicate the location of the post-Flood boundary. However, even if the post-Flood boundary is identified as e.g. Upper Miocene at one location and Middle Pleistocene at a different location, this doesn't invalidate the use of the geological column as a convention for discourse, though it may call into question its accuracy as a reflection of the empirical rock record. The Flood geologist can say that the catastrophic nature of the Flood and the compressed absolute timescale reflected in the rock record (relative to the deep time framework) both provide enough reason in themselves to expect some geographical variation in the stratigraphic placement of the post-Flood boundary with respect to the geological column. Flood geology has no *a priori* commitment to the geological column. Therefore, using the geological column as a convention for discourse doesn't necessarily imply either that there is, or that there isn't, any real-world correspondence between the empirical rock record and the geological column. As such, if we merely use the geological column as a convention for geological discourse, we can set aside the debates about how well the geological column represents the reality of the empirical rock record and focus our attention on the placement of the boundary without the need to engage in an extended discussion on the reality of the geological column. Later, we can go back and remove the assumption of the geological column and either refine the placement of the Flood/post-Flood boundary within local or regional rock columns or use another global model, such as Walker's biblical geological model.⁶

The Flood/post-Flood boundary controversy is mainly focused at or above the Cretaceous/Tertiary boundary in the geological column; i.e. in the Cenozoic erathem (figure 5). The ‘early Cenozoic’ corresponds to the Paleogene system and the ‘late Cenozoic’ corresponds to the Neogene and Quaternary systems (figure 5). If all or most of the Cenozoic is post-Flood, then the activity deduced from geology, paleontology, tectonics, and geomorphology of the Cenozoic must occur *after* the Flood and diversification as seen in Cenozoic fossils occurred after the Flood. Conversely, if the boundary is in the late Cenozoic, especially in the very late Cenozoic, diversification after the Flood evinced in the rock record is slight.

The three main schools of thought

Three main schools of thought or models have developed in regard to the location of the Flood/post-Flood boundary (table 1).¹³ They represent a considerable divergence of opinion and as a result, contradictory concepts of the Flood have developed.

The Precambrian/Paleozoic Boundary Model

The first school of thought believes that the Flood/post-Flood boundary is generally in the late Paleozoic.^{14–22} One suggested model is the recolonization model, which states that the rocks and fossils in the geological column above the boundary represent a ‘recolonization’ of organisms from Flood refugia. According to this model, animals came off Noah’s Ark and spread from the “mountains of Ararat”

beginning in the Paleozoic. However, some advocates place the boundary event even lower—in the late Precambrian. One such model is the Collapse Tectonics Model,²³ which was recently reviewed in this journal.²⁴

Advocates of the Precambrian/Paleozoic Boundary Model believe that certain features in the rocks seem to require much more time than a one-year Flood allows, such as dinosaur tracks, eggs, and scavenged bonebeds. They attempt to find more time for these features to form after the Flood. Because of the scale of the sedimentary rocks, they must posit at least regional- to continental-scale post-Flood catastrophes,²⁵ such as continental split at the time of Peleg²⁵ to explain such a large amount of post-Flood sedimentary rocks and fossils. Moreover, they do not seem to be careful in suggesting certain features of the rocks and fossils could not be produced during the Flood. We have a few hundred such challenges in the earth sciences anyway. Some we have found good answers for,²⁶ while many others await research.

Few creation scientists accept the Precambrian/Paleozoic location of the Flood/post-Flood boundary. Because the model is not well developed, I will not compare this model in this series of papers. Many find that the model causes many more problems than it solves.²⁷

The K/T Boundary Model

The second school of thought believes the Flood/post-Flood boundary is near the Cretaceous/Tertiary (K/T) boundary in the geological column.^{28–33} Some within this school believe the boundary could be in the early Cenozoic,^{34,35} at least in places. I will simplify and group all these positions into the K/T Boundary Model for the sake of discussion, realizing that some favour the early Cenozoic.

In this school of thought, most, if not all, the Cenozoic strata would have been laid down after the Flood. Similar to advocates of the Precambrian/Paleozoic Boundary Model, they conclude that certain rocks and fossils, as well as deduced processes, take more time than a one-year Flood. For instance, they point out that the Cenozoic cooling curve, especially from ocean bottom sediments, is evidence of slow cooling after the Flood.³⁶ They also believe that kangaroos found in karst deposits in Australia, dated as old as Miocene, show that the boundary is near the K/T.³⁷ The kangaroos would have to spread out from the “mountains of

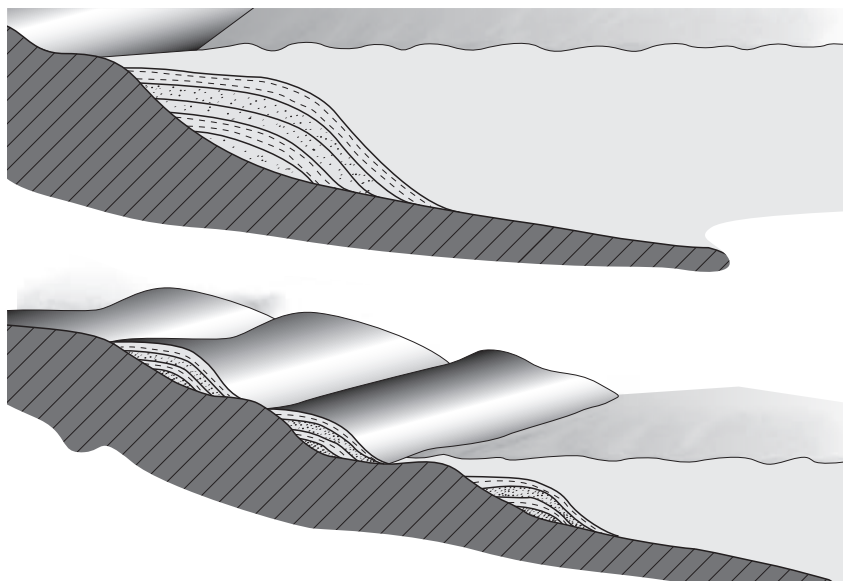


Figure 4. Comparison of the continental shelf and slope today (top) with multiple continental shelves that likely would have formed if the Flood did not end for many years in some areas (bottom) (drawn by Mrs Melanie Richard)

Subdivisions of Geologic Time and Symbols				
ERA	PERIOD AND SUBPERIOD		EPOCH	AGE (Ma)
CENOZOIC	QUATERNARY		Holocene	2.6
			Pleistocene	←
	TERTIARY	NEOGENE SUBPERIOD	Pliocene	5.3
			Miocene	23.0
		PALEOGENE SUBPERIOD	Oligocene	33.9
			Eocene	55.8
			Paleocene	←
MESOZOIC	CRETACEOUS		Late	65
			Early	145
	JURASSIC		Late	
			Middle	
	TRIASSIC		Early	200
			Late	
			Middle	
		Early	251	
PALEOZOIC	PERMIAN		Late	
			Middle	←
	PENNSYLVANIAN		Late	
			Middle	
			Early	320
	MISSISSIPPIAN		Late	
			Early	359
			Late	
	DEVONIAN		Middle	
			Early	416
			Late	
	SILURIAN		Middle	
			Early	444
	ORDOVICIAN		Late	
Middle				
		Early	488	
CAMBRIAN		Late		
		Middle		
		Early	542	
PROTEROZOIC				
				2500
ARCHEAN				
				3800

Figure 5. The geological column from 3.8 Ga ago to the present. Arrows on right side show the three main boundary locations.

Ararat” and reach Australia in the early to mid Cenozoic. Fossil occurrences also seem to indicate that much of the Cenozoic is post-Flood.^{38–40}

However, this school of thought needs to explain geomorphological features on the Earth’s surface that appear to have been formed by fast-moving water.^{41,42} For instance, planation and erosion surfaces have planed folded and faulted rock, sometimes leaving behind erosional remnants (figure 6). Some of these planation surfaces are huge, such as the one that has flattened much of Africa with variable faulting and folding afterwards.⁴³ Hard, well-rounded quartzite cobbles and boulders have been transported by water for many hundreds of kilometres east and west from their source in the Rocky Mountains of central and northern

Idaho and extreme western Montana.^{41,42} The long transport is about 1,200 km into central Saskatchewan and south-west Manitoba, Canada, from Idaho. Another example is the thick Cenozoic strata found in many basins of the world, such as the 26–28 km of mostly Cenozoic strata from the 450 km diameter South Caspian Basin!⁴⁴ There is also the problem of thick, widespread coal seams.⁴⁵

Recently, Whitmore has offered an explanation for how the Cenozoic can be post-Flood.⁴⁶ This defence extends his previous articles on the subject from the 2008 International Conference on Creationism.^{47,48} He has presented a case that post-Flood mass wasting of generally unlithified sediments occurred during mountain uplift, heavy precipitation, a lack of vegetation, giant earthquakes, meteorite impacts, and massive volcanic activity. Whitmore concludes he can explain the geology, paleontology, tectonics, and geomorphology by placing the Cenozoic after the Flood. Mass wasting or mass movement refers to all the processes by which soil and rock are eroded and transported downslope by gravity.⁴⁹ It includes slow displacements, such as creep, and rapid movements such as rock falls, rockslides, and debris flows.

The Late Cenozoic Boundary Model

The third school of thought believes the Flood/post-Flood boundary is near the end of the Cenozoic.^{50–60} Critics of this position have claimed advocates believe the boundary is at the Pliocene/Pleistocene.³³ This is not so. Late Cenozoic is a broad range because we are assuming the geological column, which is not precise enough to pinpoint the boundary worldwide. There too many problems with the precise dating of the geological column to use it for more than a general order.^{10–12}

In practice, this school of thought believes that most of the lithified sedimentary rocks are from the Flood, and the boundary is near or at the surface of these rocks. Therefore, it assigns practically all Cenozoic catastrophes to the Flood. This school of thought questions whether inferences made from Cenozoic activity could have taken place after the Flood. For instance, how can thousands of metres of erosion over wide areas occur? How can thousands of metres of deposition occur in basins and other areas of the world? How can thick, widespread Miocene coal seams be explained? How can thick, widespread ‘evaporites’ from the late Miocene of the Mediterranean area be explained after the Flood? Post-Flood catastrophism in this model would include greater volcanism, earthquakes, shifts in the land at faults, probably due to the earth settling down after the Flood, but on a considerably smaller scale than other schools of thought. And of course the Ice Age is one of these ‘catastrophes’ postulated by this school.

On the other hand, the late Cenozoic Flood Model must explain a few hundred earth science challenges that appear



Figure 6. The erosion surface with erosional remnants on the eastern Australia Tableland (view west). The sedimentary rocks below the erosion surface of the Tableland are tilted at various angles.

to take more time than a one-year Flood would allow, such as ‘fossil reefs’, worm burrow zones, basalt lava flows, and buried soil zones.⁶¹ The Flood/post-Flood boundary can be very difficult to pinpoint in some regions, for instance the Ashfall Fossil Beds State Historical Park in north-east Nebraska, USA,⁶² the super-eruptions of Yellowstone National Park,⁶³ and the sediments and sedimentary rocks along the Arctic coast of North America.⁶⁴

An interdisciplinary approach required

There is a great deal of subjectivity in such an evaluation of post-Flood catastrophism:

“The list of criteria is not exhaustive, and there may be debate on the relevance of each criterion. The criteria are currently qualitative, but it is hoped that further research will enable quantification.”⁵⁵

Whitmore and Garner concur:

“Obviously, this is a subjective evaluation on our part and may be open to criticism. Other young-age creationists may disagree with us concerning the relative importance of our criteria and may be able to suggest other criteria we have not included.”⁶⁵

This is precisely why defining the post-Flood boundary must be an interdisciplinary endeavour. Because of the importance of developing a sophisticated Flood model, and the controversy over the nature and extent of post-Flood catastrophism, it is essential to study as much evidence as possible before determining the Flood/post-Flood boundary. Just a few fields of study, such as sedimentology, paleontology, or geomorphology, are not enough. They should be included but along with other fields of earth science. One field taken alone may be misleading.

The way forward

The only way forward on this contentious issue is to lay all the ‘cards’ on the table. For this I am grateful that Whitmore has presented mechanisms that can account for the Cenozoic being post-Flood. For my part, I too will encourage disagreement. In this way, we can all analyze the pros and cons of our different assessments of the nature of post-Flood catastrophism, and hopefully come to a consensus.

In forthcoming papers, I plan to identify over 30 features generally evident into the Late Cenozoic rocks that reflect Flood processes rather than post-Flood catastrophism. I will not address just one field or subfield of study but many within the earth sciences. I will also reflect on current assessments of these features by those who apportion most of the Cenozoic to post-Flood catastrophism to determine the relative difficulty current post-Flood explanations of these features face.

It is possible that with more research the K/T Boundary Model may be able to explain one or several of these evidences better than the Late Cenozoic Boundary Model. However, the K/T Boundary Model would have to better explain most of these 30-plus evidences to be the superior model.

Acknowledgements

I thank all the reviews and editors, including my wife Beverly, for improving the content and the flow of this article.

References

1. Cavanaugh, D.P., Wood, T.C. and Wise, K.P., Fossil equidae: a monobaraminic, stratomorphic series; in: Ivey Jr, R.L. (Ed.), *Proceedings of The Fifth International Conference on Creationism, technical symposium sessions*, Creation Science Fellowship, Pittsburgh, PA, pp. 143–153, 2003.
2. Wise, K.P. and Croxton, M., Rafting: a post-Flood biogeographic dispersal mechanism; in: Ivey Jr, R.L. (Ed.), *Proceedings of The Fifth International Conference on Creationism, technical symposium sessions*, Creation Science Fellowship, Pittsburgh, Pennsylvania, PA, pp. 465–477, 2003.
3. This would especially apply in areas of continuous deposition through the boundary. But even in areas of post-Flood erosion or mass wasting, there would be a boundary if deposition occurred afterwards.
4. Hedberg, H.D., Continental margins from the viewpoint of the petroleum geologist, *AAPG Bulletin* 54(1):6, 1970.
5. King, L.C., *Wandering Continents and Spreading Sea Floors on an Expanding Earth*, John Wiley and Sons, New York, p. 199, 1983.
6. Walker, T., A Biblical geological model; in: Walsh, R.E. (Ed.), *Proceedings of the Third International Conference on Creationism, technical symposium sessions*, Creation Science Fellowship, Pittsburgh, PA, pp. 581–592, 1994.
7. Kostic, S., Parker, J. and Marr, G., Role of turbidity currents in setting the foreset slope of clinoforms prograding into standing fresh water, *J. Sedimentary Research* 72(3):353–362, 2002.
8. Kennett, J., *Marine Geology*, Prentice-Hall, Englewood Cliffs, NJ, p. 29, 1982.
9. Reed, J.K. and Oard, M.J. (Eds.), *The Geologic Column: Perspectives within Diluvial Geology*, Creation Research Society Books, Chino Valley, AZ, 2006.
10. Oard, M.J., The geological column is a general Flood order with many exceptions; in: Reed, J.K. and Oard M.J. (Eds.), *The Geological Column: Perspectives within Diluvial Geology*, Creation Research Society Books, Chino Valley, AZ, pp. 99–121, 2006.
11. Oard, M.J., Is the geological column a global sequence? *J. Creation* 24(1): 56–64, 2010.

12. Oard, M.J., The geological column is a general Flood order with many exceptions, *J. Creation* 24(2):78–82, 2010.
13. Tyler, D.J., Flood models and trends in creationist thinking, *Creation Matters* 2(3): 1–3, 1997.
14. Garner, P., Where is the Flood/post-Flood boundary? Implications of dinosaur nests in the Mesozoic, *J. Creation* 10(1):101–106, 1996.
15. Garner, P., Continental flood basalts indicate a pre-Mesozoic Flood/post-Flood boundary, *J. Creation* 10(1):114–127, 1996.
16. Garton, M., The pattern of fossil tracks in the geological record, *J. Creation* 10(1): 82–100, 1996.
17. Tyler, D.J., Tectonic controls on sedimentation in rocks from the Jurassic Series (Yorkshire, England); in: Walsh, R.E. (Ed.), *Proceedings of the Third International Conference on Creationism*, technical symposium sessions, Creation Science Fellowship, Pittsburgh, PA, pp. 535–545, 1994.
18. Tyler, D.J., A post-Flood solution to the chalk problem, *J. Creation* 10(1): 107–113, 1996.
19. Robinson, S.J., From the Flood to the Exodus: Egypt's earliest settlers, *J. Creation* 9(1):45–68, 1995.
20. Robinson, S.J., Can Flood geology explain the fossil record? *J. Creation* 10(1): 32–69, 1996.
21. Scheven, J., The Flood/post-Flood boundary in the fossil record; in: Walsh, R.E. and Brooks C.L. (Eds.), *Proceedings of the Second International Conference on Creationism*, volume II, Creation Science Fellowship, Pittsburgh, PA, pp. 247–256, 1990.
22. Scheven, J., The Carboniferous floating forest—an extinct pre-Flood ecosystem, *J. Creation* 10(1):70–81, 1996.
23. Budd, P.G., *Earth in Cataclysm*, self-published, 2014.
24. Whitmore, J.H., The importance and necessity of quality peer review, review of *Earth in Cataclysm* by Philip G. Budd, *J. Creation* 28(2):51–54, 2014.
25. Nelson, D.P., *Peleg: Early Earth Movements*, self-published, 2007.
26. Oard, M.J. and Reed J.K. (Eds.), *Rock Solid Answers: The Biblical Truth Behind 14 Geological Questions*, Master Books and Creation Research Society Books, Green Forest, AR and Chino Valley, AZ, 2009.
27. Reed, J.K., Kulikovskiy, A.S. and Oard, M.J., Can recolonization explain the rock record? *Creation Research Society Quarterly* 46(1):27–39, 2009.
28. Austin, S.A., A creationist view of Grand Canyon strata; in: Austin, S.A. (Ed.), *Grand Canyon—Monument to catastrophism*, Institute for Creation Research, Santee, CA, pp. 57–82, 1994.
29. Austin, S.A., Baumgardner, J.R., Humphreys, D.R., Snelling, A.A., Vardiman, L. and Wise, K.P., Catastrophic plate tectonics: a global flood model of earth history; in: Walsh R.E. (Ed.), *Proceedings of the Third International Conference on Creationism*, technical symposium sessions, Creation Science Fellowship, Pittsburgh, PA, pp. 609–621, 1994.
30. Brand, L., *Faith, Reason, and Earth History*, Andrews University Press, Berrien Springs, MI, 1997.
31. Wise, K.P., *Faith, Form, and Time: What the Bible Teaches and Science Confirms about Creation and the Age of the Universe*, Broadman & Holman Publishers, Nashville, TN, 2002.
32. Wise, K.P. and Richardson, S.A., *Something from Nothing—Understanding What You Believe about Creation and Why*, Broadman & Holman Publishers, Nashville, TN, 2004.
33. Ross, M.R., Evaluating potential post-Flood boundaries with biostratigraphy—the Pliocene/Pleistocene boundary, *J. Creation* 26(2):82–87, 2012.
34. Snelling, A.A., *Earth's Catastrophic Past: Geology, Creation & the Flood*, volume 2, Institute for Creation Research, Dallas, TX, pp. 751–761, 2009.
35. Snelling, A.A., The Geology of Israel within the Biblical Creation-Flood Framework of History: 2. The Flood Rocks, *Answers Research J.* 3: 267–309, 2010.
36. Vardiman, L., *Sea-Floor Sediments and the Age of the Earth*, Institute for Creation Research, Dallas, TX, 1996.
37. Snelling, A.A., *Earth's Catastrophic Past: Geology, Creation & the Flood*, vol. 2, Institute for Creation Research, Dallas, TX, pp. 760–761, 2009.
38. Ross, M.R., Evaluating potential post-Flood boundaries with biostratigraphy—the Pliocene/Pleistocene boundary, *J. Creation* 26(2):82–87, 2012.
39. Walker, T. and Ross, M.R., Forum on the Flood/post-Flood Boundary, *J. Creation* 28(2):60–68, 2014.
40. Arment, C., Fossil snakes and the Flood boundary in North America, *J. Creation* 28(3):13–15, 2014.
41. Oard, M.J., *Flood by Design: Receding Water Shapes the Earth's Surface*, Master Books, Green Forest, AR, 2008.
42. Oard, M.J., ebook. *Earth's Surface Shaped by Genesis Flood Runoff*, 2013; michael.oards.net/GenesisFloodRunoff.htm.
43. Oard, M.J., The remarkable African planation surface, *J. Creation* 25(1):111–122, 2011.
44. Knapp, C.C., Knapp, J.H. and Connor, J.A., Crustal-scale structure of the South Caspian Basin revealed by deep seismic reflection profiling, *Marine and Petroleum Geology* 21:1073–1081, 2004.
45. Oard, M.J., Comment on “Fossil snakes and the Flood boundary in North America”, *J. Creation* 29(1):56–57, 2015.
46. Whitmore, J., The potential for and implications of widespread post-Flood erosion and mass wasting processes; in: Horstemeyer, M. (Ed.), *Proceedings of the Seventh International Conference on Creationism*, Creation Science Fellowship, Pittsburgh, PA, 2013.
47. Whitmore, J.H. and Garner, P., Using suites of criteria to recognize pre-Flood, Flood, and post-Flood strata in the rock record with application to Wyoming (USA); in: Snelling, A.A. (Ed.), *Proceedings of the Sixth International Conference on Creationism*, Creation Science Fellowship, Pittsburgh, PA, pp. 425–448, 2008.
48. Whitmore, J.H. and Wise, K.P., Rapid and early post-Flood mammalian diversification evidences in the Green River Formation; in: Snelling, A.A. (Ed.), *Proceedings of the Sixth International Conference on Creationism*, Creation Science Fellowship, Pittsburgh, PA, pp. 449–457, 2008.
49. Neuendorf, K.K., Mehl, Jr, J.P., and Jackson, J.A., *Glossary of Geology*, 5th edn, American Geological Institute, Alexandria, VA, p. 397, 2005.
50. Whitcomb Jr, J.C. and Morris, H.M., *The Genesis Flood*, Baker Book House, Grand Rapids, MI, 1961.
51. Holt, R.D., Evidence for a late Cainozoic Flood/post-Flood boundary, *J. Creation* 10(1):128–167, 1996.
52. Woodmorappe, J., Studies in Flood geology: clarifications related to the ‘reality’ of the geological column, *J. Creation* 10(2):279–290, 1996.
53. Baumgardner, J., CPT explains the rapid sea level drop in the latter portion of the Flood, *J. Creation* 25(2):61–64, 2011.
54. Oard, M.J., Where is the Flood/post-Flood boundary in the rock record? *J. Creation* 10(2):258–278, 1996.
55. Oard, M.J., Defining the Flood/post-Flood boundary in sedimentary rocks, *J. Creation* 21(1):98–110, 2007.
56. Oard, M.J., Is the K/T the post-Flood boundary?—part 1: introduction and the scale of sedimentary rocks, *J. Creation* 24(2):95–104, 2010.
57. Oard, M.J., Is the K/T the post-Flood boundary?—part 2: paleoclimates and fossils, *J. Creation* 24(3):87–93, 2010.
58. Oard, M.J., Is the K/T the post-Flood boundary?—part 3: volcanism and plate tectonics, *J. Creation* 25(1):57–62, 2011.
59. Oard, M.J., *The Flood/Post-Flood Boundary Is in the Late Cenozoic with Little Post-Flood Catastrophism*, 2014; michael.oards.net/PostFloodBoundary.htm.
60. Clarey, T., The whopper sand, *Acts & Facts* 44(3):14, 2015.
61. Budd, ref. 23, p. 23.
62. Oard, M.J., Are the Ashfall site sediments and fossils post-Flood? *Creation Research Society Quarterly* 46(2):81–91, 2009.
63. Oard, M.J., Relating the Lava Creek ash to the post-Flood boundary, *J. Creation* 28(1):104–113, 2014.
64. Oard, M.J., The Flood/post-Flood boundary Arctic coast of North America, *J. Creation* (submitted).
65. Whitmore and Garner, ref. 47, p. 434.

Michael J. Oard has an M.S. in atmospheric science from the University of Washington and is now retired after working as a meteorologist with the US National Weather Service in Montana for 30 years. He is the author of *Frozen in Time*, *Ancient Ice Ages or Gigantic Submarine Landslides?*, *Flood by Design*, *Dinosaur Challenges and Mysteries*, and *Exploring Geology with Mr. Hibb*. He serves on the board of the *Creation Research Society*.

Towards a creationary view of why speciation occurs

Jean K. Lightner

While informed creationists recognize that species are not equivalent to kinds, we don't have an adequate understanding of why different species exist within the various created kinds. Using the biblical history and information from the scientific literature, it appears there is good reason why speciation occurs. Organisms diversify as they reproduce and fill the earth. Maintaining separate diverse populations, which biologists usually classify as different species, provides a reservoir for variability. Through hybridization, this variability can be shared between the populations. There are examples where this has enabled a population to recover from unusually harsh environmental extremes. It has also been proposed that it provides the basis for adaptive radiation, where organisms rapidly diversify and fill a variety of environmental niches. In the end, the process we call speciation appears to be an important means by which God provides for His creatures even in the current fallen world.

The Bible gives us a historical framework for understanding the origin of life and some key events in natural history. We know that God created plant and animal life according to their kinds and blessed them with the ability to reproduce and fill the earth (Genesis 1:11–12; 20–22; 24–25). We are also aware of a severe genetic bottleneck, particularly in unclean flying and terrestrial creatures, at the time of the global Flood (Genesis 6–8). From this historical information and the biological and genetic information we have from observing the world today, it is clear that many animals have diversified and speciated since creation and the Flood.^{1–3}

This brings up several important questions that are crucial to understanding biology. What is the source of this diversity? What processes are involved in diversification and speciation? In a biblical model, why does speciation occur? There is enough information available that we should be able to get some handle on speciation from a biblical worldview.

The origin of diversity

It would seem that some of the diversity seen within kinds was created. At a very minimum, there was a male and female for (dioecious) sexually reproducing kinds. For diploid creatures, it is quite possible that many loci were created heterozygous, containing two distinct alleles, or versions of the gene.

While currently available data does not permit us to make a good estimate of created diversity in most vertebrate kinds, Dr Robert Carter has made a rough estimate of created diversity in humans. Using HapMap data, he proposed that a significant proportion of common single nucleotide polymorphisms (SNPs) found in humans were probably

created alleles. There are about 10 million common variants, and the HapMap data covers a significant sampling of these. He noted that there are two nucleotides at each of these positions that appear to be widely distributed in humans. Widely distributed alleles are generally ancestral and he proposes that 10 million positions or more were likely heterozygous in Adam and Eve.⁴

It is important to recognize that a designed mechanism that can alter the DNA sequence on a chromosome had to be in place to account for the pattern that we see today in created alleles. This designed mechanism is known as homologous recombination. It operates during meiosis, that special series of cell divisions that produces the cells (egg and sperm) necessary for sexual reproduction. Without it, homologous chromosomes do not pair up and then segregate properly. Further, homologous recombination allows for alleles to be shuffled between the corresponding chromosomes, providing for an incredible number of different combinations that underlies much of the diversity we see today.

Yet there is observed diversity that clearly goes beyond what can be accounted for by created alleles and homologous recombination.⁵

In addition to widely distributed alleles, the human population has many more variants that are called private alleles. Given the number of generations since the Flood, human population size, and known mutation rates, it does not appear to be a problem to account for these in a biblical timeframe.⁴ In fact, several studies by evolutionists have concluded that most rare variants in humans have arisen within the last 10,000 years.⁶ In addition to SNPs, structural variants (e.g. indels, inversions, etc.) appear, not only in humans, but in animals and plants as well.

Some instances of diversity may be from something that has been called latent design, also known as mediated design.^{7,8} For example, there are several different pathways plants use for photosynthesis, and the efficiency of the pathway depends on the environment the plant is in.⁹ From an evolutionary perspective it appears that C_4 photosynthesis has arisen multiple times. Even in a creationary model, which generally recognizes plants in the same family as descending from the same kind, it appears this may have happened. Interestingly, genes for the C_4 pathway have been identified in plants using the C_3 but they are not switched on. One possible explanation is that previously existing genes were merely switched on to account for the ‘appearance’ of C_4 photosynthesis in plants.

Epigenetic change is a mechanism that can switch on or off genes, as is transposable element (TE) movement. Epigenetic changes are used regularly throughout the lifetime of an organism to adjust gene transcription to its needs. There have been examples of environmentally induced epigenetic changes that are passed transgenerationally; it appears this may have been one factor involved in adaptation among Darwin’s finches.¹⁰

TEs could be involved with mediated design or other pathways of designed genomic change. A number of articles by creationists have addressed this.^{11–14} TEs were first identified as a source of phenotypic change in maize. It now appears that they can not only provide an alternative promotor, but may also shift the function of genes through alternative splicing and alternative polyadenylation.¹⁵

While some diversity may be derived from switching things on or around, additional diversity comes from knocking things out. Some of the interesting variety seen in coat colour patterns among many different mammals is from ‘breaking’ a protein receptor or causing it to be permanently switched on. Either way, this receptor is no longer responsive to its signalling molecule.¹⁶ At another locus, changes affect the migration of pigment cells (melanocytes) during embryogenesis and white spotting is the result of no melanocytes in that location.¹⁷

There are several examples where gene duplication followed by concerted evolution (i.e. a series of nucleotide changes that are adaptive) appears to have taken place.^{18,19} Despite the terminology, detailed examination indicates the evolutionary model can’t account for this naturalistically (i.e. via random mutation and natural selection). The idea that programming is involved in germline mutations has been ridiculed by evolutionists but it should be no surprise to creationists. There are several DNA editing enzymes that are used in the immune system.^{20,21} There is no reason why these or other DNA editing enzymes may not also play a valuable role in germline editing. It has been noted that meiosis is mutagenic beyond what is attributable to

homologous recombination and it is perfectly reasonable to suspect some of these changes may have purpose.²²

Thus, diversity has multiple sources. Evolutionists like to propose that all changes to DNA are essentially accidents or the result of unrepaired errors. While accidents and errors certainly do occur, it is unlikely that they have played a major role in adaptive genomic changes given the multiple *designed* mechanisms that could plausibly be involved to induce *strategic* DNA changes. It is important to recognize that adaptive changes can result in specialization and thus may be adaptive in a limited number of conditions. Further, in this fallen world, some adaptive genetic changes come at a significant cost (e.g. sickle-cell trait).

The purpose of diversity

The long-term study of Galápagos finches done by Drs Peter and Rosemary Grant provides an understanding of how diversity can benefit a population of organisms.²³ The medium ground finch (*Geospiza fortis*) was chosen for study because of the variability within the population. Birds with smaller beaks ate smaller, softer seeds and the birds with larger beaks ate larger, harder seeds. When a drought hit that eliminated the supply of smaller seeds, the birds with smaller beaks were more profoundly affected by starvation. Yet the population survived. Thus, variability within the population was important to help it withstand harsh environmental conditions that can arise in years with extreme weather conditions. It would have also been useful if there was a gradual shift in food source, but that was not observed.

A hedge against environmental uncertainties, the ability to overcome environmental challenges, and the ability to exploit new environmental niches as creatures fill the earth are very reasonable suggestions as purposes for diversity within a population. Yet from a creationist perspective there is more: it also shows God’s provision as He sustains life (Psalm 147:8,9; Matthew 6:25–34; Colossians 1:17)²⁴ and has been seen as evidence of His overflowing abundance and mercy in this fallen world.²⁵ This should become even more evident as we move on.

The origin of diverse populations / separate species

In the allopatric model of speciation, separate populations form when there is a barrier of some sort that prevents them from interbreeding. This can be a geographic barrier, such as a mountain range, a wide sea, or a great distance between optimal habitats. Over time these populations can diverge enough that biologists consider them separate species. Interestingly, this process is believed to have played an important role in the radiation of finches on the Galápagos Islands. It is thought that if these populations come back into

contact again, they will have diverged enough that they will not normally interbreed.²⁶

The Grants observed examples of closely related species coming in contact with each other on the island of Daphne Major. Some of these species were residents at the time the study began; others migrated in.²⁷ The Grants noted that normally there are behavioural barriers which prevent mating between species.²⁸ Young males normally learn to sing the same song as their fathers, and females tend to mate with birds that are morphologically similar to their fathers and sing the same song. This is usually enough to keep the birds mating within their own species. Occasional breakdowns occur for various reasons. For example, the father may die and the offspring may learn the song of a neighbour that belongs to a different species.

The phenotypic divergence that takes place during speciation may often be from the mechanisms discussed previously under the origin of diversity. Presumably many of the genetic (or epigenetic) changes would be adaptive. It would take volumes to fully explore the origin of diverse populations and mechanisms of diversification between them, and this is beyond the scope of this paper. For now, this provides enough of a basis to begin to explore the purpose of separate species.

The purpose of diverse populations / separate species

Based on field observations, there are several obvious benefits for separate, diverse populations that are classified as separate species based on morphology. In the example with the Galápagos finches, the effects of the periodic droughts (mainly due to the El Niño/La Niña cycle) on the medium ground finch (*G. fortis*; figure 1) varied depending on weather conditions in the previous years. While one drought preferentially eliminated birds with smaller beaks, another drought, which occurred after a series of very wet years, preferentially eliminated birds with larger beaks. This difference was because the seed abundance at the beginning of the drought was different, so a different food source was depleted first. However, the droughts were not the only factor identified as affecting the average beak size of the birds. The medium ground finch hybridized with several

other species that lived on the island (i.e. the cactus finch, *G. scandens*, and the small ground finch, *G. fuliginosa*) and regained some of the lost variability in beak size.

While the number of individuals in the population which hybridize with a second species is generally quite low, hybridization is a widespread phenomenon where closely related species come into contact with each other. It is being increasingly recognized that adaptive alleles can enter a population through these hybridization events. This is termed ‘adaptive introgression’.²⁹

In addition to providing a valuable reservoir of adaptive alleles to recover from harsh environmental extremes (natural selection in action), many are proposing examples where hybridization is involved in speciation.³⁰ In some cases the hybrids go on to form a distinct species.³¹ Beyond this, in certain conditions hybridization appears to provide a basis for adaptive radiation, the rapid diversification of organisms into new forms which can effectively exploit the resources in a variety of niches.^{32–34} In other words, speciation through hybridization appears to be one of the means by which God’s creatures reproduce and fill the earth (Genesis 1:22; 8:17).



Figure 1. The medium ground finch population was affected by a severe drought which changed the average beak size. Some of the lost variability was recovered by hybridizing with closely related species.

Many details as to why this occurs remain to be fully elucidated, though it appears both genetic and epigenetic factors can play a role.³⁵ From what is known already, it should be more likely for adaptive alleles to arise where there are more individuals, and multiple populations/species would provide this. Further, the effect of a mutation is often dependent on the genetic background; it could be that the likelihood that they will appear is influenced by this as well. Finally, hybridization sometimes releases a burst of transposable element activity. This has been recognized in the creation literature.³⁶ Many more examples have appeared in the secular literature since then.³⁷ This may be one source by which diversity is increased so adaptive radiation can occur.

The origin of hybrid sterility/inviability

There are situations where there is little or no discernable difference in the viability or fertility of the hybrids.³⁸ At other times hybridization results in hybrid vigour, a condition where offspring perform better than the parents. This phenomenon is often exploited in domestic species for agricultural purposes. The opposite can occur as well and is known as outbreeding depression.³⁰ From both a biblical and a scientific perspective, perhaps the most challenging aspect of speciation to explain is the origin and purpose of hybrid sterility or inviability.

There are many types of changes that may contribute to sterility or inviability. Pairing during meiosis depends on sequence similarity between homologous chromosomes. Significant differences in sequence can impair pairing, potentially resulting in failure to complete meiosis. Chromosomal rearrangements can contribute to this sequence divergence.³⁹ The effects vary from no perceivable difference, to reduced fertility (when only some cells fail to complete meiosis), to infertility associated with complete meiotic arrest. In addition to affecting fertility, sequence changes, including sizeable inversions, can affect viability.⁴⁰

In crops, male sterility can have several sources. There is cytoplasmic male sterility and germline male sterility. In the former, mutations in mitochondrial genes that affect the regulation of nuclear genes are the basis of the infertility. Several dozen such mutations have been identified in over a dozen different crop species. In the case of the latter, the sequence changes are within nuclear genes that affect the regulation of other nuclear genes affecting reproduction. In some cases of germline male sterility, environmental factors are involved. Epigenetic regulation by non-coding RNAs may allow for restoration of fertility with changes in growing conditions such as temperature or photoperiod.⁴¹

One fairly common pattern associated with speciation in animals is a rapid sequence divergence in male sex-biased

genes (e.g. in *Drosophila*⁴² and mice⁴³). These are often non-synonymous changes which appear to be correlated with abnormal patterns of gene expression in hybrid offspring. A large proportion of these genes are on the X chromosome, which is often referred to as the ‘large X effect’. The genes are normally expressed during spermatogenesis, but are misexpressed in hybrids which are infertile. Both *Drosophila* and mammalian males are heterogametic (XO and XY respectively), and are more likely than female hybrids to be affected by infertility. This phenomenon is described by Haldane’s Rule, which states: “When in the F1 [hybrid] offspring of two different animal races one sex is absent, rare, or sterile, that sex is the heterozygous [heterogametic] sex.”⁴⁴ This rapid divergence in X chromosome sequence of male-biased genes appears to be at least one reason why this pattern of male infertility is observed in these taxa.

The sequence changes are not limited to male-biased genes or the X chromosome. Autosomal loci have been shown to contribute as well. For example, in the house mouse (*Mus musculus*; figure 2) there are several subspecies where crosses can result in infertile males. In crosses between the subspecies *M. musculus musculus* and *M. musculus domesticus*, both a region on the X chromosome and another on chromosome 17 are found to be essential in the complete meiotic arrest associated with hybrid males having *M. musculus musculus* mothers. Despite being essential, incompatibility between alleles at these two loci is not sufficient to cause this phenotype; other loci are involved as well.⁴³

An underlying cause of meiotic breakdown appears to be asynapsis of chromosomes derived from different subspecies (i.e. heterosubspecific chromosomes). This suggests a divergence on the chromosomes themselves influencing the incompatibility. Thus, infertility is a result of a complex interaction between *trans* (loci on another chromosome)



Figure 2. The house mouse is undergoing speciation. Despite the fact that males are infertile in some crosses, there is significant gene flow in hybrid zones in Europe.

and *cis* (loci on the same chromosome) factors. Not only are multiple genetic loci involved, but sterility is associated with large-scale alteration of gene expression that shows a complex pattern of interaction.⁴⁵

While one might be inclined to suggest that incompatibilities arise from purely degenerative genomic changes (i.e. errors), this does not account for the pattern seen. Instead, there appear to be coordinated changes that occur within a species (or subspecies) that maintain fertility and viability.⁴⁶ Appropriate compensatory change is not something that can arise by chance processes. Instead, these changes appear to be possible because developmental systems and gene networks are designed with plasticity that allows for adaptation.⁴⁷

The purpose of post-zygotic reproductive isolation (hybrid infertility)

The effects of hybrid infertility are interesting. The infertility is often partial, affecting only one sex, usually males in mammals and females in birds (females are the heterogametic sex in birds). In some cases it is further limited to crosses in one direction. This is the case in the house mouse example already discussed, as only males with mothers from the *musculus* subspecies are normally affected. The severe sterility phenotype was not generally seen when the hybrids were crossed (F2), though the range of phenotypes suggests additional recessive loci affecting fertility.⁴⁵ All of this allows for considerable gene exchange in hybrid zones, though often the regions of the genome most strongly associated with the infertile phenotype do not cross the boundary well.⁴⁸

It has long been recognized that various regulatory changes can be associated with phenotypic diversity and adaptation.⁴⁹ These types of changes are involved in hybrid infertility as well. Thus, it is possible that hybrid infertility is not purposeful in itself, but is a side effect of effective adaptive changes accumulating separately in different populations. This would seem to make sense, given that the ability to reproduce and fill the earth was a blessing God bestowed on His creatures at Creation (Genesis 1).

However, since the phenomenon of hybrid infertility does alter gene flow between separate populations, it could be argued that it may serve a purpose in limiting the flow of particular genes. Certainly it does limit the gene flow of particular genic regions, but we are a long way from understanding if this is ever a truly beneficial phenomenon.

There is a case where infertility is a beneficial phenomenon; it is related to its appearance in crop species and has significantly benefited agricultural production. In order to harness the advantages of hybrid vigour, inbred lines need to be crossed. The problem is that crops such as corn are

monoecious; both sexes are in the same plant. To produce hybrid seed, the male portion of one of the lines must be inactivated to avoid self-pollination. At one time this was done manually (by cutting off the tassels), mechanically or chemically. This was expensive and had potentially harmful effects on the environment. However, with the appearance of male infertility genes, plants can now be bred so male sterility can be activated when needed and then restored if desired.⁴¹

Conclusions

This brief overview of some of the basic components of speciation shows that this phenomenon fits well within the biblical model. God blessed his creatures to reproduce and fill the earth, and so they have. The underlying mechanisms of diversification show design and forethought. This includes genomic networks that were designed to change adaptively. The origin and maintenance of separate populations allows for further adaptation of each, as well as a source of genetic variety that can be transferred between them as they adapt to the challenges they face in the world today. Thus, God's abundant provision and care for His creatures can be seen in what is currently known about speciation.

References

1. Lightner, J.K., Life: Designed by God to Adapt, *Answers in Depth* 3(1), www.answersingenesis.org/articles/aid/v3/n1/life-designed-to-adapt, 4 June 2008.
2. Lightner, J.K., Identification of species within the sheep-goat kind (Tsoan monobaramin), *J. Creation* 20(3):61–65, 2006; creation.com/images/pdfs/tj/j20_3/j20_3_61-65.pdf.
3. Lightner, J.K., Identification of a large sparrow-finch monobaramin in perching birds (Aves: Passeriformes), *J. Creation* 24(3):117–121; 2010, creation.com/sparrow-finch-baramin.
4. Carter, R.W., The Non-Mythical Adam and Eve! Refuting errors by Francis Collins and Biologos, creation.com/historical-adam-biologos.
5. Lightner, J.K., Karyotypic and allelic diversity within the canid baramin (Canidae), *J. Creation* 23(1):94–98, 2009; creation.com/images/pdfs/tj/j23_1/j23_1_94-98.pdf.
6. Tennessen, J.A., Bigham, A.W. and O'Conner, T.D. *et al.*, Evolution and functional impact of rare coding variation from deep sequencing of human genomes, *Science* 337(6090):64–69, 2012; and Fu, W., O'Conner, T.D. and Jun, G., *et al.*, Analysis of 6,515 exomes reveals recent origin of most human protein-coding variants, *Nature* 493(7431):216–220, 2013.
7. Wood, T.C. and Cavanaugh, D.P., A baraminological analysis of subtribe Flaveriinae (Asteraceae: Helenieae) and the origin of biological complexity, *Origins* 52:7–27, 2001.
8. Wood, T.C., Mediated design, ICR Impact #363, www.icr.org/i/pdf/imp/imp-363.pdf.
9. Gowik, U. and Westhoff, P., The path from C3 to C4 photosynthesis, *Plant Physiology* 155:56–63, 2011.
10. Skinner, M.K., Gurerrero-Bosagna, C., Haque, M.M., Nilsson, E.E., Koop, J.A.H., Knutie, S.A. and Clayton, D.H., Epigenetics and the evolution of Darwin's Finches, *Genome Biology and Evolution* 6(8):1972–1989, 2014.
11. Wood, T.C., The AGEing process: Rapid post-Flood intrabaraminic diversification caused by Altruistic Genetic Elements (AGEs), *Origins* 54: 5–34, 2002.
12. Terborg, P., The design of life: part 3—an introduction to variation-inducing genetic elements, *J. Creation* 23(1):99–106, 2009.

13. Terborg, P., The design of life: part 4—variation-inducing genetic elements and their function, *J. Creation* **23**(1):107–114, 2009.
14. Shan, E.L., Transposon amplification in rapid intrabaraminic diversification, *J. Creation* **23**(2):110–117, 2009.
15. Ayarpadikannan, S., Lee, H.E., Han, K. and Kim, H.S., Transposable element-driven transcript diversification and its relevance to genetic disorders, *Gene* **558**(2): 187–194, 2015.
16. Lightner, J.K., Genetics of coat color I: The melanocortin 1 receptor, *Answers Research J.* **1**:109–116, 2008.
17. Lightner, J.K., Post-Flood mutations of the KIT gene and the rise of white colouration patterns, *J. Creation* **24**(3):67–72, 2010.
18. Lightner, J.K., Gene duplications and nonrandom mutations in the family cercopithecidae: evidence for designed mechanisms driving adaptive genomic mutations, *CRSQ* **46**(1): 1–5, 2009.
19. Lightner, J.K., Gene duplication, protein evolution, and the origin of shrew venom, *J. Creation* **24**(2):3–5, 2010; creation.com/images/pdfs/tj/j24_2/j24_2_3-5.pdf.
20. Chandra, V., Bortnick, A. and Murre, C., AID targeting: old mysteries and new challenges, *Trends in Immunology* **36**(9):527–535, 2015.
21. Harris, R.S. and Dudley, J.P., APOBECs and virus restriction, *Virology* **479–480**: 131–145, 2015.
22. Lightner, J.K., Meiotic recombination—designed for inducing genomic change, *J. Creation* **27**(1):7–10, 2013.
23. Grant, P.R. and Grant, B.R., *40 Years of Evolution: Darwin's Finches on Daphne Major Island*, Princeton University Press, Princeton, NJ, 2014.
24. Lightner, J.K., The effect of mutations down on the farm, *Answers in Depth* 2010, from answersingenesis.org/genetics/mutations/the-effect-of-mutations-down-on-the-farm/ accessed, 4 September 2015.
25. Sanders, R., The best seat in the house, *Answers* **3**(3): 66–68, 2008.
26. Grant and Grant, ref. 23, pp. 4–8.
27. Grant and Grant, ref. 23, pp. 35–39; 103–121; 140.
28. Grant and Grant, ref. 23, pp. 138–165.
29. Hedrick, P.W., Adaptive introgression in animals: examples and comparison to new mutation and standing variation as sources of adaptive variation, *Molecular Ecology* **22**(18):4606–4618, 2013.
30. Abbott, R. *et al.*, Hybridization and speciation, *J. Evolutionary Biology* **26**(2): 229–246, 2013.
31. This appears to have happened on Daphne in the Galápagos Islands. See chapter 13 in Grant and Grant, ref. 23.
32. Palmer, D.H. and Kronforst, M.R., Divergence and gene flow among Darwin's finches: A genome-wide view of adaptive radiation driven by interspecies allele sharing, *Bioessays* **37**(9):968–974, 2015.
33. Litsios, G. and Salamin, N., Hybridisation and diversification in the adaptive radiation of clownfishes, *BMC Evolutionary Biology* **14**:245, 2014.
34. Stankowski, S. and Streisfeld, M.A., Introgressive hybridization facilitates adaptive divergence in a recent radiation of monkeyflowers, *Proceedings of the Royal Society: Biological sciences* **282**(1814), 2015.
35. Greaves, I.K., Gonzalez-Bayon, R., Wang, L., Zhu, A., Liu, P.C., Groszmann, M., Peacock, W.J. and Dennis, E.S., Epigenetic changes in hybrids, *Plant Physiology* **168**(4):1197–1205, 2015.
36. Jerlström, P., Jumping wallaby genes and post-Flood speciation, *J. Creation* **14**(1): 9–10, 2000.
37. Belyayev, A., Bursts of transposable elements as an evolutionary driving force, *J. Evolutionary Biology* **27**(12):2573–2584, 2014.
38. Grant and Grant, ref. 23, pp. 156–157.
39. Lightner, J.K., Karyotype variability within the cattle monobaramin, *Answers Research J.* **1**:77–88, 2008.
40. Sugimoto, M., Developmental genetics of the mouse t-complex, *Genes & Genetic Systems* **89**(3):109–120, 2014.
41. Chen, L. and Liu, Y.G., Male sterility and fertility restoration in crops, *Annual Review of Plant Biology* **65**:579–606, 2014.
42. Ortiz-Barrientos, D., Counterman, B.A. and Noor, M.A.F., Gene expression divergence and the origin of hybrid dysfunctions, *Genetica* **129**:71–81, 2007.
43. Bhattacharyya, T., Reifova, R., Gregorova, S., Simecek, P., Gergelits, V., Mistrik, M., Martincova, I., Pialek, J. and Forejt, J., X chromosome control of meiotic chromosome synapsis in mouse inter-subspecific hybrids, *PLoS Genetics* **10**(2):e1004088.
44. Haldane, J.B.S., Sex-ratio and unisexual sterility in hybrid animals, *J. Genetics* **12**:101–109, 1922.
45. Turner, L.M., White, M.A., Tautz, D. and Payseur, B.A., Genomic networks of hybrid sterility, *PLoS Genetics* **10**(2):e1004162, 2014.
46. A similar pattern with different specifics is documented in hybrids between *M. musculus* subspecies *domesticus* and *molossinus*. Oka, A., Takada, T., Fujisawa, H. and Shiroishi, T., Evolutionarily diverged regulation of X-chromosomal genes as a primal event in mouse reproductive isolation, *PLoS Genetics* **10**(4):e1004301, 2014.
47. Lightner, J.K., Developmental system plasticity—a brief initial assessment of extent, design, and purpose within the creation model, *J. Creation* **28**(3):67–72, 2014.
48. Macholán, M., Baird, S.J.E., Dufková, P., Munclinger, P., Bimová, B.V. and Piálek, J., Assessing multilocus introgression patterns: a case study on the mouse X chromosome in central Europe, *Evolution* **65**(5):1428–1446, 2011.
49. Wray, G.A., The evolutionary significance of cis-regulatory mutations, *Nature Reviews Genetics* **8**(3):206–216, 2007.

Jean K. Lightner worked just over three years as a veterinary medical officer for the US Department of Agriculture before resigning to stay at home to raise and teach her four children. Since high school, she has been interested in creation related issues and their relevance to understanding the world and living a consistent Christian life. Now that her children are grown, she is deeply involved in creation research. She has contributed numerous articles to creation journals, magazines, and websites and serves as a board member for the Creation Research Society. She is an adjunct with Liberty University Online and a member of the Creation Biology Society, Christian Veterinary Mission and the National Animal Health Emergency Response Corps.

Empirical data support seafloor spreading and catastrophic plate tectonics

Timothy L. Clarey

Recent creationist literature has been filled with papers critical of catastrophic plate tectonics, even suggesting that a schism has divided Flood geology. Creation scientists who accept the validity of plate motion have been accused of 'naturalism' and have been labelled as 'remodellers'. However, creationist acceptance of plate tectonics does not entail any sort of acquiescence to naturalism. Six types of empirical data are presented which imply significant horizontal movement of coherent lithospheric plates during the Flood. Much of these data are independent of the secular geologic timescale, including heat flow in the ocean crust and seismic tomography data which illustrate the presence of subducted oceanic lithosphere within the mantle. Unfortunately, most of these data supporting catastrophic plate tectonics are rarely discussed by critics. In contrast, this paper suggests that the best explanation of all available geologic data supports rapid horizontal plate movement during the Flood. The catastrophic plate tectonics model further offers a mechanism for the flooding of the continents, the subsequent lowering and draining of the floodwaters, and a cause for the post-Flood Ice Age. The only 'schism' in Flood geology is one perceived by the scientists who fail to acknowledge all of the empirical data.

Several recent articles have been published in the creation literature that have been critical of plate tectonics (PT), and specifically catastrophic plate tectonics (CPT).¹⁻³ There has even been the suggestion of a 'schism' developing in Flood geology between the geologists who accept CPT and those who do not.⁴ Advocates of CPT have been labelled as 'remodellers' and have been accused of merely speeding up naturalistic processes like plate motion and nuclear decay.⁴ But as Ross has pointed out: "Labelling some creation geologists as holding a 'remodelled naturalistic approach', while wrapping themselves in the mantle of 'reconstructed biblical geology', is inaccurate and self-serving."⁵

For those that do not accept CPT as a mechanism, a different approach to creating a biblical geologic framework has been suggested. These creation scientists claim to be able to 'reconstruct' geologic history based solely "on an outline derived from the Bible";⁴ thereby liberating biblical history from geologic history, including the secular timescale and biostratigraphy. But, to date, only a generalized timescale has been developed within this 'reconstructed' biblical framework, and details from the vast majority of site-specific locations are still largely lacking.⁴

Part of the reason for the paucity of published, site-specific details on the part of the 'reconstructed' camp may involve their rejection of long-distance correlation methods. As Ross has stated:

"Moreover, the geological approach advocated by Froede and Akridge ['reconstructors'] applies models that seek to synthesize a global record of earth history while at the same time *necessarily* rejecting geologic correlation methods that could connect disparate geologic systems. How could such methods possibly succeed, when they discard necessary tools?"⁵

Furthermore, the 'reconstructed' camp has accused the 'remodellers' (advocates of CPT as a Flood mechanism) of accepting concepts and ideas derived from naturalism.⁴ But they have offered no clear evidence to back up this claim. To openly accuse other creation scientists of basing their scientific views on naturalism is completely unsubstantiated. Again, as Ross has pointed out: "Are we to assume that all of the descriptive geology published in the past three centuries is so deeply flawed that only fresh eyes of certain young-earth creationists can properly document these rocks?"⁵ How do these authors determine what constitutes empirical science based on naturalism from science not based on naturalism? Are we to ignore all scientific papers put forth by non-Christians and only accept research by scientists holding our own worldview? Science can be done by both secular scientists and by creation scientists.

Both camps claim miracles were necessary

Some members of the 'reconstructed' camp have also accused the remodellers of needing to invoke a series of miracles to explain CPT.^{4,6} They see such miracles as 'unshrunk cloth sewn onto an old garment' (Mark 2:21) and compare these miracles to an ill-conceived patch for a reluctant anti-biblical philosophy of history. Ironically, these same authors invoke their own set of miracles for geologic events when it serves their purposes and do not provide clear definitions or a clear explanation.^{4,6} Froede and Akridge (so-called reconstructors) have themselves admitted: "The application of miracles is a necessary part of defining biblical history. There are many geological events mentioned in the Bible that cannot be explained outside of 'miracles'."⁶

Froede and Akridge also call on miracles to initiate the Flood and to provide the source of the rain and as a reason for uplift of the continents at the close of the Flood.⁶ Why are these miracles justified yet others are not? Who is to judge whether a miracle is needed? Their claims that the rapid horizontal movement of the plates across the earth requires a miracle, that accelerated nuclear decay requires another miracle, and that global deposits require yet another miracle, are no different than calling on miracles to initiate the Flood as they themselves have done.⁶ Just because there are aspects of geology and CPT theory that are presently not understood is no reason to suggest miracles must be necessary to fill the gaps in our knowledge base.

There is no doubt miracles occurred during the Flood event as described in the Bible, but advocates of CPT do not simply invoke miracles at every 'gap' as suggested by Froede and Akridge.⁶ Many of the accusations of 'miracles' merely reflect our present lack of understanding and our incomplete scientific models and technology limitations. Plate tectonics, and in particular CPT, is a well-documented, working model that provides a Flood mechanism independent of a patchwork of repeated miracles. It serves as a framework to explain much of the geological data that has been collected for hundreds of years.

Does CPT explain every geological feature? Of course it does not. Does it rely on a strict adherence to the secular chronostratigraphic column so much so that it cannot be separated from it? I argue no, because there are many aspects of CPT that stand independent of biostratigraphy, radioisotope dating methods, and the timescale itself, some of which will be discussed below. Do all advocates for CPT agree on the same Flood/post-Flood boundary? Unlikely, but all agree that the observed geological data can be best explained by some type of rapid plate movement during the Flood year that separated the present continents. Exactly which days and how many days during the Flood this movement was in operation is unknown at this time.

Throughout this paper, I will assume naturalism is a godless philosophy that can be separated from true science. Science is a process that includes observation, empirical data collection, classification, and experimentation. Rocks can be identified based on mineralogy and texture. Thicknesses of rocks can be measured and the fossils in those rocks can be identified and recorded. Interpretation and worldview come into play when we postulate how and when those rocks arrived at that specific location. But the rocks and fossils are themselves factual data points. Admittedly, most of the historical earth sciences study non-repeatable events that happened only once in the past.

A short history of plate tectonics theory

Contrary to the claims of some of its critics,⁴ the theory of plate tectonics is not derived solely from naturalism but from empirical data collected over many decades by geologists and geophysicists. In the early 20th Century, Alfred Wegener used the fit of the continents and the match of fossils and mountain ranges across vast oceans to suggest that the continents had split in the past. These ideas were not accepted by the geological community at the time. Instead, his ideas were ridiculed and ignored. It was not until the 1960s, after immense quantities of oceanographic data were collected, and the publication of Harry Hess's hypothesis of seafloor spreading⁷ and J. Tuzo Wilson's early work on plate tectonics,⁸ that these ideas slowly became accepted. Nearly 50 years after Wegener first proposed the concept of continental drift, the secular community reluctantly acknowledged plate motion because they were overwhelmed with empirical data.

Throw out the baby with the bathwater?

Recent papers critical of PT and CPT¹⁻³ concentrate on rather insignificant and minor unresolved issues, such as small inconsistencies in plate boundaries and movement directions³ and/or reflect on misunderstandings of current research undertaken by those who support CPT.⁹ In the process, these authors have disregarded the bulk of the data that support PT and CPT. For example, Oard has been openly critical of using the results from over 2000 GPS receiver stations worldwide.¹⁰ He has claimed that these measurements cannot be extrapolated to plate movement directions.¹⁰ However, Baumgardner has shown (his figure 1) that these GPS stations have recorded uplift/subsidence and horizontal displacement details consistent with modern and past plate motions.⁹ In his response, Baumgardner explained: "Oard's statement contradicts the clear conclusion these GPS

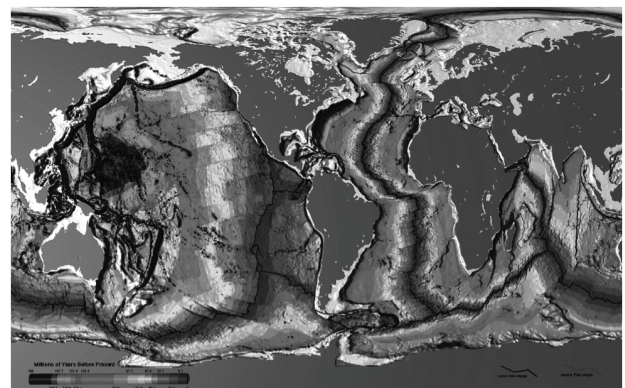


Figure 1. Map showing the age of the ocean crust from 'Earth seafloor crust age 1996-2'

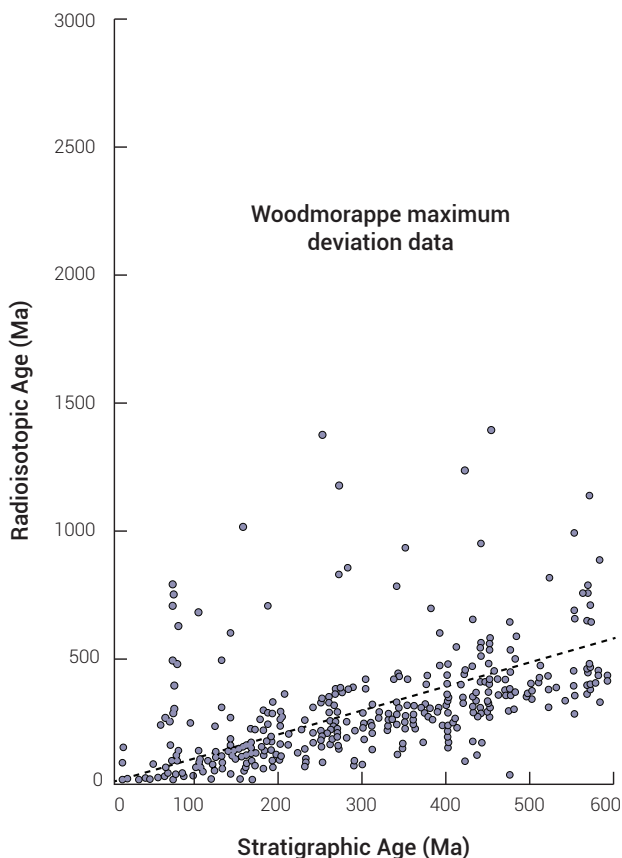


Figure 2. There is a fairly well-defined general agreement of absolute radioisotope ages and stratigraphic ages.

measurements so powerfully convey: that the plates indeed are moving in a coherent plate-like manner.”⁹

It was the information gathered from the study of the oceans in the 1950s, 1960s, and 1970s that unlocked the mystery of PT and eventually CPT. Oceanographic data clearly demonstrate a systematic increase in the age of the ocean crust (figure 1) with distance from the ocean ridges that cannot be disregarded merely because it involves absolute dating methods. As creation scientists we must not be found guilty of throwing out ‘the baby with the bathwater’ in this regard. In most cases, absolute dates have been shown to provide reasonable relative dates (figure 2),^{11–13} strengthening the argument that the ocean crust and lithosphere did indeed originate and spread from the ocean ridges in a systematic manner.

Although some have been critical of the relationship between absolute dates and biostratigraphic age,¹⁴ Baumgardner countered by writing:

“One of the important implications of the RATE research is that, while the dates which radioisotope methods give under the assumption of constant transmutation rates obviously cannot be correct, the relative dates from a large fraction of these

determinations nevertheless might well be valid.”¹¹

And he concluded with: “It is a tool we simply cannot afford to ignore.”

Oard’s criticism of the scatter in the data shown in figure 2 also was addressed by Humphreys.¹⁴ He explained that some of the scatter would be expected if accelerated radioactive decay had occurred.¹³ He postulated that rapid cooling of lava may occasionally lead to similar dates at vastly different stratigraphic horizons due to non-equilibrium conditions.

Empirical data that are independent of age dates

In addition to the age pattern observed for the ocean crust (figure 1), there is also a tremendous amount of supporting data that affirms seafloor spreading. Many of these data sets are independent of absolute dating methods. Consider for example:

- The temperatures recorded in the ocean crust and the heat flow measured near the ocean ridges show a systematic pattern of cooling with distance away from the ridges in both directions. Sclater and Francheteau originally defined a relationship between heat flow and distance from the ocean ridge back in 1970 that still holds today.¹⁵ This empirical data set is not dependent on any dating methods, absolute or relative.
- The ocean topography also reflects the age distribution and the heat flow pattern of the crust beneath. The elevation of the seafloor is highest near the ridges (where it has the highest heat flow) and drops off systematically with distance in both directions. Sclater and Francheteau, again back in 1970, initially demonstrated this relationship by simply plotting bathymetry data against distance from the ridge, not against age of the crust.¹⁵ This data set is again independent of any age dates.

The magnetic reversal ‘stripe’ pattern shows symmetry on each side of the ocean ridges, supporting simultaneous seafloor spreading outward in both directions from the



Figure 3. Bathymetric map of the seafloor showing clearly defined ocean ridges in every ocean. The ridges circle the globe twice and are the source of new ocean crust.

ridges. Critics have pointed out inconsistencies in this data set³ but the overall pattern is still readily observed in the magnetic profiles recorded on either side of the ocean ridges. The overall symmetry to this data cannot merely be dismissed. The patterns initially observed by Heirtzler et al. for the ridge south-west of Iceland show a near-perfect symmetry for 200 km in both directions about the ridge.¹⁶ Vine remarked: “This finding, together with the symmetry and linearity of the magnetic anomalies about the Juan de Fuca and Gorda ridges, recently described by Wilson, provides convincing confirmation of the two most obvious corollaries of a literal interpretation of the Vine-Matthews hypothesis: (i) linear magnetic anomalies should parallel or subparallel ridge crests, and (ii) for many latitudes and orientations the anomalies should be symmetric about the ridge.”¹⁷ The raw magnetic anomalies are based only on distance from the ridges and not on age dating of the rocks themselves.

- c. The very presence of the ocean ridges suggests a common origin by seafloor spreading. Ocean ridges are found in every ocean of the world (figure 3). The ridge system extends 70,000 km from ocean to ocean, connecting across all of the seas. They consist of huge, linear mountain chains rising 3,000 m above the abyssal plains with a rift valley at the centre, actively spewing out basaltic magma yet today. There is no ocean today that exists without a ridge system.
- d. The correlation of oils from Brazil and West Africa show demonstrable similarities when the continents are reunited (figure 4).¹⁸ The unique geochemical signature in the oil families found on opposite sides of the Atlantic, when reunited, show an unmistakable match that can only be explained by later plate movement. The geochemical differences found in the oils from north to south along the coasts depend on the uniqueness of the source rocks themselves and not the perceived age of the rocks. These data indicate similar source rocks were deposited at different locations up and down the coasts of both continents that were later separated by plate motion.
- e. The internal images of the mantle (tomography) show visible lithospheric slabs of oceanic crust going down

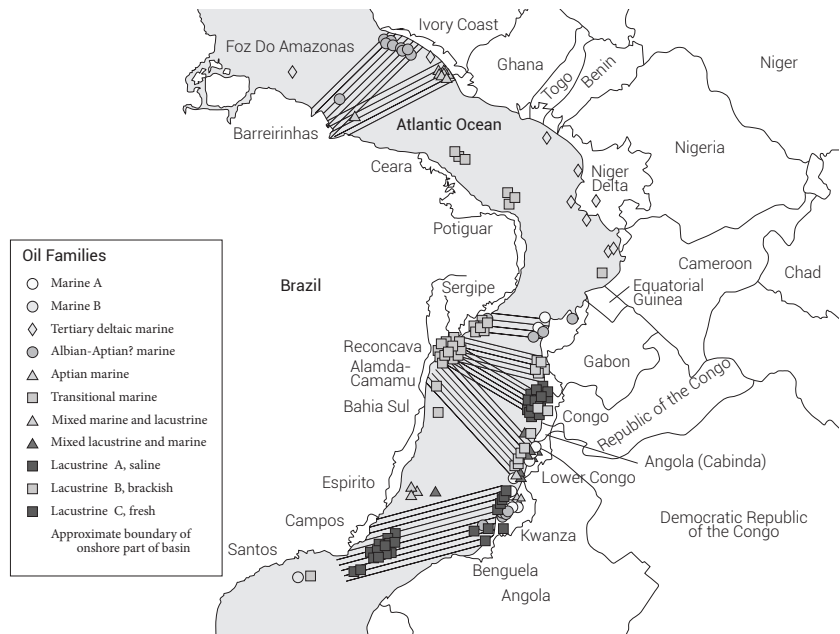


Figure 4. Map of the South Atlantic showing the correlation of families of oils and their similarities between Brazil and West Africa. The intervening Atlantic Ocean is reduced to illustrate the correlations. Although some ‘geologic time’ and ‘environmental interpretation’ is implied in the naming of the various oil families, the matching of geochemical signatures at each site from north to south, and across the Atlantic, is undeniable. Oil chemical signatures are independent of perceived geologic ‘age’ as they are based on chemical differences in liquid content regardless of rock unit. These data strongly support plate movement has occurred to separate these source rocks and these oils. (After Brownfield and Charpentier¹⁸.)

Preliminary Determination of Epicenters 358,214 Events, 1963 - 1998

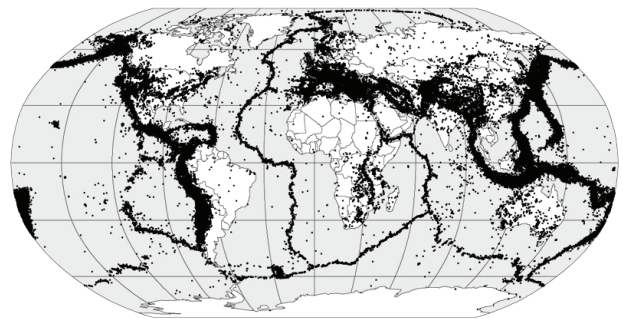


Figure 5. Map of earthquake epicenters from 1963–1998 showing the linear patterns that define the tectonic plates

hundreds of kilometres beneath ocean trenches and into subduction zones.¹⁹ These are not merely faults as some have proposed,²⁰ but 100-km-thick slabs of brittle, dense rock descending into the mantle.¹⁹ The cooler temperatures exhibited by these subducted slabs of rock create a thermal dilemma for the secular and old-earth geologists (traditional PT) who have to demonstrate how these slabs

have remained cold for millions of years. Colder, subducted slabs are best explained by runaway subduction just thousands of years ago during the great Flood.²¹

There is no other viable way to explain the ubiquitous presence of ocean ridges, the ocean heat flow pattern observed, the bathymetry pattern of the seafloor, the symmetry of the magnetic signals in the rocks surrounding the ridges, the match of the oil chemistry between Africa and South America, the seismic tomography showing the presence of subducted lithosphere, and the pattern of age of the crust other than seafloor spreading and plate movement. These data cannot be denied, ignored, or explained away as dependent on the chronostratigraphic timescale. Empirical data, independent of the chronostratigraphic timescale, demonstrate that the modern ocean lithosphere was completely created anew in conveyor belt fashion at the ridges, causing systematic spreading in both directions.

Catastrophic plate tectonics is not a naturalistic theory, it is a scientific interpretation of a plethora of factual data that conform to biblical history! There is nothing in the Bible

that precludes horizontal plate motion and seafloor spreading. Suggesting that creation scientists should merely dismiss the data as ‘naturalism’ is completely unjustified.

Scientists cannot pick and choose

How do the critics of CPT explain these data? In most cases, they do not address these data in their papers and in doing so either deny these data exist or dismiss the majority of these data as based on wholly naturalistic interpretations. Creation scientists cannot pick and choose the empirical data sets they want to use but should include all appropriate data sets in any Flood explanation.

CPT explains plate boundaries

The majority of the plates are well defined by maps of current earthquake activity (figure 5). Admittedly, there are still a few, small, unresolved micro-plates,³ and some of the modern plate movement directions may not be exactly as predicted.³ However, earthquake epicentres still clearly trace the boundaries of discernable and coherent lithospheric plates even today, nearly 4,500 years after most of the plate movement ceased. Further support for these plate boundaries is shown by the linear chains of volcanoes found along the edge of the Pacific plate, associated with the Pacific Ocean’s ‘ring of fire’. In addition, many of the major mountain ranges of the world also follow the edges of active plate boundaries, such as the Andes and Himalayas. These long linear chains of mountains run parallel, and in close proximity, to many of the convergent-style plate boundaries, explaining the reason for many of the world’s largest and deepest earthquakes.

Secular geologists admit they do not have all the answers to explain every aspect of PT. Likewise, many creation geologists who advocate CPT do not claim to understand all aspects of the theory either but accept it as a sound working model steeped in empirical data. Secular scientists and creation scientists alike debate how subduction is initiated²² and how the major continents originated,²³ but most

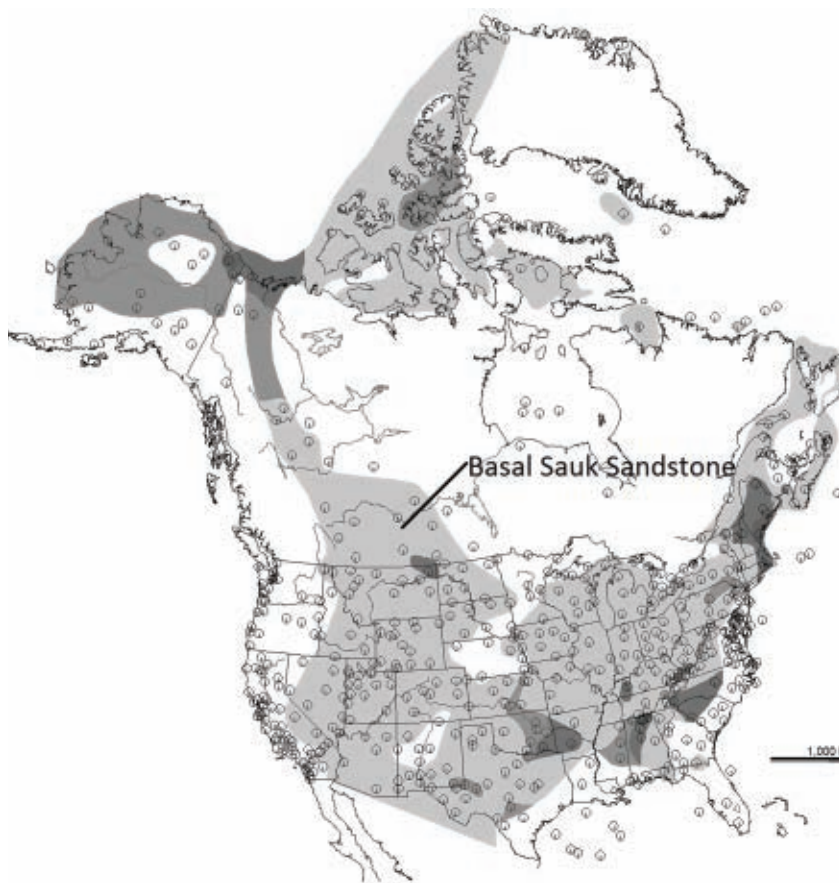


Figure 6. Map of the basal lithology of the Sauk Megasequence across North America. The extent of the one, continual sandstone layer is identified in light grey. (Image courtesy of Davis J. Werner.)

do not use this lack of understanding to question the overall validity of the PT and/or CPT model, respectively.

CPT explains the flooding of the continents

The Bible states plainly that the “fountains of the great deep were broken up, and the windows of heaven were opened” during the initiation of the Flood (Genesis 7:11). In terms of CPT, the fountains of the great deep may be a description of the rifting that took place at the ocean ridges and even within continents.²⁴ Obviously, the rainfall described as the “windows of heaven opening” must have contributed to the Flood in some capacity. But, in addition, because newly created oceanic lithosphere is relatively hot, less dense and more buoyant, the CPT model provides an additional source for the water to completely flood the continents. After its formation at the ridges, the freshly-formed, lower-density oceanic lithosphere simply pushed the top of the seafloor up from below, displacing ocean water and forcing it on to the land. Snelling has calculated that this elevated seafloor could have raised global sea level by as much as 1.6 km, greatly helping to flood the continents.²⁵

Rapid movement of the plates during runaway subduction further supplied tsunami-like waves to wash across the land surfaces, helping to deposit blanket-type sediments across continents (figure 6). Recent numerical modelling by Baumgardner has found that repetitive tsunami waves, caused by rapid plate movement, could result in water accumulation several kilometres deep on the continents, contributing to the flooding.²⁶ The runaway subduction model also provides a mechanism to lower the continental crust in the proximity of the subduction zones, causing more extensive flooding of the land and creating room for several kilometres of sediment.^{21,27} Numerical models show that friction against the subducting oceanic lithosphere as it descends will likewise drag down the edges of the continents about 3 km.^{21,27}

The floodwaters began their recession when God stopped the “fountains of the great deep and the windows of heaven” and “the rain from heaven was restrained” (Genesis 8:2). Subsequent cooling of the newly created ocean lithosphere later in the Flood year (after Day 150) offers an additional explanation for the lowering of the floodwaters. As the 100-km-thick ocean lithosphere cooled, it sank, lowering the bottom of the oceans and drawing the water back off the continents and into the ocean basins.

How do CPT critics raise the water level to Flood the continents? Rainfall alone seems insufficient. What is their definition of the ‘fountains of the great deep’, if not some type of plate boundary? What is their mechanism for raising sea level to flood the tops of the pre-Flood hills? How do the CPT critics explain the continent-scale sedimentation patterns? Creation scientists who are critical of CPT provide

only vague and generalized answers to these questions or do not discuss their views on these issues in their most recent papers.^{1–3}

CPT explains the Ice Age

Finally, CPT provides a mechanism for the Ice Age that occurred at the end of the Flood. A hot, newly formed ocean crust would have provided tremendous amounts of heat to the ocean waters above. This would have raised the overall temperature of the ocean and caused a much greater amount of evaporation, resulting in staggering amounts of precipitation.²⁸ In addition, the increased volcanic activity from the subduction zone volcanoes within the ‘ring of fire’ and elsewhere late in the Flood would have placed huge volumes of ash and aerosols into the atmosphere, cooling the climate most noticeably in the higher latitudes.²⁸ The unique magmas generated by the partial melt of subducted ocean lithosphere provides the perfect recipe for explosive, ash-rich eruptions. These types of volcanoes (stratovolcanoes) are highest in silica, making them thicker, and water-rich and more explosive.²⁹ The net result of hotter oceans and tremendous silica-rich, volcanic activity brought on from plate motion would have provided the impetus for the subsequent Ice Age.²⁸ Basalt-rich magmatic volcanoes (shield volcanoes), as commonly observed across the bulk of the ocean basins, do not produce the necessary ash-rich explosions to generate sun-blocking aerosols.²⁹ Finally, as the ocean lithosphere slowly cooled and volcanic activity diminished over the next centuries after the Flood, the Ice Age would also have ended as abruptly as it began.²⁸

Critics of CPT have more difficulty explaining the origins of the stratovolcanoes and their unique silica-rich magmas as they do not accept subduction, partial melting, and its resultant mantle disruption during the Flood year.^{20,30} They have problems justifying the observed differences in volcanic magmas in general. They also have a greater difficulty explaining the necessary heating of the ocean water to provide the precipitation for the Ice Age without the rapid creation of a completely new seafloor to heat the ocean from below during the Flood.^{10,28,30}

No schism in Flood geology

The empirical data that support CPT are not steeped in naturalism as some have claimed.⁴ It is not true that all data that support CPT are tied exclusively to interpretations of biostratigraphy and/or the secular timescale.² And not all creation scientists who subscribe to CPT agree on every issue. There is still considerable debate on the Flood/post-Flood boundary even among CPT advocates.^{9,31} Catastrophic plate tectonics simply presents a mechanism that explains much of the geology that is observed and measured,

particularly in terms of the oceanographic and tomographic data so often ignored in recent publications. The overwhelming geological evidence supports catastrophic horizontal plate movement. In addition, CPT allows for ample vertical uplift, mountain-building and down-drop of portions of the continental crust late in the Flood year.³² Vertical movements are the result of isostatic adjustments caused by crustal thickening and disruptions in the upper mantle during subduction.^{21,32}

The only schism in Flood geology is one perceived by the scientists who refuse to acknowledge the plethora of empirical data indicating horizontal plate movement during the Flood year. There are many issues still unresolved in Flood geology, such as determining an agreed upon Flood/post-Flood boundary, but plate movement should not be one of them. The empirical data are sufficient to put much of this criticism to rest!

Creation scientists should be critical of theories and hypotheses, but we also need to immerse ourselves in the latest data and the most recent scientific findings, secular or otherwise. “Iron sharpens iron”, but we have to be careful to not become so critical that our science is hampered and divided and fails to advance.

References

- Oard, M.J., Difficulties with plate tectonics—Pacific Ocean bottom features, *J. Creation* 29(2):86–91, 2015.
- Froede, C.R., Jr, Akridge, A.J. and Reed, J.K., Phanerozoic animal tracks: A challenge for catastrophic plate tectonics, *Creation Res. Soc. Quart.* 51(2): 96–103, 2014.
- McGuire, M., Plate tectonics—inconsistencies in the model, *J. Creation* 28(2): 104–115, 2014.
- Froede, C.R., Jr and Akridge, A.J., A developing schism in Flood geology, *J. Creation* 27(2):49–54, 2013.
- Ross, M.R., A developing schism in Flood geology, Letters to the Editor, *J. Creation* 27(3):46–47, 2013.
- Froede, C.R., Jr and Akridge, A.J., A developing schism in Flood geology, Letters to the Editor, *J. Creation* 27(3):48, 2013.
- Hess, H.H., History of Ocean Basins; in: Engel, A.E.J., James, H.L. and Leonard, B.F. (Eds.), *Petrologic studies: a volume in honor of A.F. Buddington*, Geological Society of America, Boulder, CO, pp. 599–620, 1962.
- Wilson, J.T., A Revolution in Earth Science, *Geotimes* (Washington DC) 13 (10): 10–16, 1968.
- Baumgardner, J.R., Global tectonics—clarity, not confusion, *J. Creation* 27(1): 99–106, 2013.
- Oard, M.J., Is plate tectonics really occurring today? *J. Creation* 26(3): 120–127, 2012.
- Baumgardner, J.R., Do radioisotope methods yield trustworthy relative ages for the earth’s rocks? *J. Creation* 26(3):68–75, 2012.
- Snelling, A.A., Radiometric dating: Making sense of the patterns, *Answers Magazine*, 1 January, 2010, answersingenesis.org/geology/radiometric-dating/radiometric-dating-making-sense-of-the-patterns/, accessed 24 June 2015.
- Humphreys, D.R., Accelerated nuclear decay: a viable hypothesis?; in: Vardiman, L., Snelling, A.A. and Chaffin, E.F. (Eds.), *Radioisotopes and the Age of the Earth: A Young-Earth Creationist Research Initiative*, Institute for Creation Research, Dallas, TX, and Creation Research Society, Chino Valley, AZ, pp. 333–379, 2000.
- Oard, M.J., Can the relative timing of radioisotope dates be applied to biblical geology? *J. Creation* 27(2):112–119, 2013.
- Slater, J.G. and Francheteau, J., The implications of terrestrial heat flow observations on current tectonic and geochemical models of the crust and upper mantle of the Earth, *Geophysical Journal of the Royal Astronomical Society* 20:509–542, 1970.
- Heirtzler, J.R., Le Pichon, X. and Baron, J.G., Magnetic anomalies over the Reykjanes Ridge, *Deep Sea Research* 13:427–433, 1966.
- Vine, F.J., Spreading of the ocean floor: New evidence, *Science* 154: 1405–1415, 1966.
- Brownfield, M.E. and Charpentier, R.R., Geology and total petroleum systems of the West-Central Coastal Province (7203), West Africa, *U.S. Geological Survey Bulletin 2207-B*, Reston, VA, pp. 1–52, 2006.
- Schmandt, B. and Lin, F.-C., P and S wave tomography of the mantle beneath the United States, *Geophysical Research Letters* 41:6342–6349, 2014.
- Brown, W.T., Jr, *In the Beginning: Compelling Evidence for Creation and the Flood*, 9th Ed., Center for Scientific Creation, Phoenix, AZ, in press.
- Baumgardner, J.R., Runaway Subduction as the Driving Mechanism for the Genesis Flood; in: Walsh, R. E. (Ed.), *Proceedings of the Third International Conference on Creationism*, technical symposium sessions, Creation Science Fellowship, Pittsburgh, PA, pp. 63–75, 1994.
- Marques, F.O., Cabral, F.R., Gerya, T.V., Zhu, G. and May, D.A., Subduction initiates at straight passive margins, *Geology* 42(4):331–334, 2014.
- Hecht, J., Rise of the upper crust, *New Scientist* 226 (3017): 36–39, 2015.
- Reed, J.K., *The North American Midcontinent Rift System: An Interpretation Within the Biblical Worldview*, Creation Research Society Monograph Series 9, Creation Research Society Books, St Joseph, MO, 2000.
- Snelling, A.A., Geophysical issues: understanding the origin of the continents, their rock layers and mountains. In: Boyd, S.W. and Snelling, A.A. (Eds.), *Grappling with the Chronology of the Genesis Flood*, Master Books, Green Forest, AR, pp. 111–143, 2014.
- Baumgardner, J.R., Numerical Modeling of the Large-Scale Erosion, Sediment Transport, and Deposition Processes of the Genesis Flood, *Answers Research J.*, in press.
- Baumgardner, J.R., Recent rapid uplift of today’s mountains, *Acts & Facts* 34(3), 2005.
- Oard, M.J., *Frozen in Time: The Woolly Mammoth, the Ice Age and the Bible*, Master Books, Green Forest, Arkansas, USA, 2004.
- Raymond, L.A., *Petrology: The Study of Igneous, Sedimentary, and Metamorphic Rocks*, Wm. C. Brown Communications., Dubuque, IA, 1995.
- Oard, M.J., Is the K/T the post-Flood boundary?—part 3: volcanism and plate tectonics, *J. Creation* 25(1):57–62, 2011.
- Ross, M.R., Evaluating potential post-Flood boundaries with biostratigraphy—the Pliocene/Pleistocene boundary, *J. Creation* 26(2):82–87, 2012.
- Austin, S.A., Baumgardner, J.R., Humphreys, D.R., Snelling, A.A. and Vardiman, L., Catastrophic plate tectonics: a global flood model of earth history; in: Walsh, R.E. (Ed.), *Proceedings of the Third International Conference on Creationism*, technical symposium sessions, Creation Science Fellowship, Pittsburgh, PA, pp. 609–621, 1994.

Timothy L. Clarey earned a Ph.D. and B.S. (summa cum laude) from Western Michigan University (USA), and a M.S. from University of Wyoming (USA) all in geology. He worked for nearly a decade as a geologist for a major oil company and then spent 17 years as a college professor. His publications include numerous articles on the geology of the Rocky Mountain region. He has written and/or co-authored four books, including *Guide to Dinosaurs* (ICR). His latest Bible-based dinosaur book, published by Master Books, is entitled *Dinosaurs: Marvels of God’s Design*. Tim currently works as a Research Associate for Institute for Creation Research in Dallas.

Changing paradigms in stratigraphy—“a quite different way of analyzing the record”

John K. Reed

At a time when stratigraphers are congratulating themselves on the explosive growth of their discipline—when the geologic timescale is becoming ever more complex, when Global Boundary Stratotype Section and Point (GSSP) and Global Standard Stratigraphic Age (GSSA) markers are expanding across the globe, and when new sophisticated methods of stratigraphic analysis dominate geology—a few geologists have been quietly crashing the party. Looking for quantitative ways to understand the sedimentary record at a meta-scale, seeing it as a fractal output of a ‘stratigraphy machine’, they examine the self-similar properties of sedimentary layering and arrive at startling conclusions that appear to invalidate two centuries of stratigraphy.

Stratigraphy has made rapid advances over recent decades. The timescale has become significantly more complex and detailed. Biostratigraphy and isotope stratigraphy have taken advantage of better technology, mathematical tools, and computer data analysis. New methods of dating and analysis, from sequence stratigraphy to cyclostratigraphy to magnetostratigraphy, have taken big strides.

However, in the middle of this rapid growth has come research that could shake the foundations of stratigraphy. A few sedimentologists and stratigraphers have been exploring ideas that challenge key assumptions about the rock record. These researchers have focused particularly on the problems of missing section, apparent piecemeal preservation, and the general incompleteness of the sedimentary record, following the observation of Derek Ager that the rock record is ‘more gap than record’. This new approach is seen in a recent paper by Drs R.J. Bailey and D.G. Smith.¹ Additional research into these problems is found in the just-released Geological Society, London, special publication, *Strata and Time*,² but this paper will summarize the ideas of Bailey and Smith as of 2010 and note their importance to both uniformitarian and diluvial stratigraphy. Please note that these geologists have no sympathy for creationism, but their work was important enough for prominent geologist Andrew Miall to conclude that they “appear to invalidate virtually the whole of the last two centuries of stratigraphic progress”³

This work represents a significant crack in the edifice of Lyellian stratigraphy and, by extension, in secular natural history itself. It may also indirectly point to a paradigm shift of benefit to diluvial geology—a modern perspective on the rock record—that points to how deposition is the result of hydrodynamic action rather than that of hierarchical stratigraphic accumulation.⁴ I address six statements of Bailey and Smith¹ that have serious ramifications for stratigraphy (figure 1).

Background

Bailey and Smith believe that stratigraphy should incorporate quantitative methods to evaluate the rock record. They see *sedimentary layering* as a key property and have created a technique called the Layer Thickness Inventory (LTI) that statistically evaluates the thickness of sedimentary layering and its relationship to the frequency at which layers of different thicknesses occur in a given section. Over all ranges of scales of strata, the LTI has shown:

“... a well-defined power law relationship between layer thickness and the number of layers of that thickness in the section. This scale invariance in layer thickness relationships is the statistical manifestation of the fact that stratigraphic layering shows a similar geometry at all scales and is, in fact, geometrically fractal.”⁵

The conclusion that the rock record is a fractal phenomenon is at the heart of their new understanding of stratigraphy. What they mean is that the lenticular geometry of deposited units is *self-similar* from the smallest laminae to the largest basin possible on our planetary scale (figure 2).⁷ Likewise, hiatuses show the same similarities on all scales, and because they see loading and unloading in the same way,⁸ then hiatuses are likewise fractal.

They have tested their method and found that it “applies to most stratigraphic data series regardless of age, facies, and net rate of accumulation”.^{10,11} They conclude that, “there may be a general, scale-invariant relationship between layer thickness and frequency of occurrence in the stratigraphic record”.¹² This relationship leads them to suggest that:

“... the fractal layering geometry is a primary stratigraphic characteristic that expresses the scales and frequencies of process related changes in sedimentation on all scales, including the effects of non-deposition and erosion.”¹²

Six Key Conclusions of Bailey & Smith (2010)

Quote	Implications
Continuous deposition ... has no theoretical or evidential basis It is fundamentally incompatible with the observable layering. Its use as a criterion for the selection of global stratotypes is correspondingly flawed.	Continuous sedimentation is a requirement of local stratigraphic type sections, including GSSPs. If not, GSSPs are not anchored in the rock record, and exact global correlation is not possible via the sedimentary or derivative fossil records.
Continuity tends to be a scale-related default assumption in stratigraphic analysis.... the notion persists that at some scale of stratigraphic resolution, continuity in accumulation can be assumed This assumption may be operationally convenient, but it is unsupported.	Stratigraphic interpretation is scale dependent, and is thus subjective because lateral and vertical continuity is assumed. This assumption "works", but is not proven by the rock record, suggesting its utility relies more on assumptions than on any strength of the method per se.
A record in which almost all the operations of the sedimentary system(s) are unrecorded, and in which hiatuses show fractal scale relationships... cannot be relied upon to preserve the sequential relationships on which... Walther's Law depends.	Walther's law of the vertical preservation of adjacent lateral facies requires sufficient preservation of these facies in the rocks. If the record is mostly gaps (at all scales), we cannot know how vertically adjacent layers were originally related.
The power law decline in rates of accumulation with increase in the time span over which they are measured...means that the age of a stratigraphic datum cannot be interpolated using the net rate of accumulation of the interval in which it occurs.... all net rates are unique to the interval for which they are estimated, precluding... extrapolation of process rates from one part of the record to another.	Stratigraphers have always used thickness of rock units as a surrogate for estimating sediment accumulation. But if net rates are local; rates change over time, and the record is sparse, we do not know how much of any unit has really been preserved. Observed present day rates are especially poor predictors of rates of accumulation of ancient strata.
...the record may not be representative of this history.... any record represents some small, but essentially immeasurable, fraction of the time span...the other is that in many environments preservation of strata in the record...is very much the exception... atypical of their time, and hence not properly representative.	The fundamental axiom of historical geology is that rocks and fossils are a coherent historical record by which we can understand the past with scientific certainty. Because much of the record of time is missing, doubt is cast on that premise. Environmental interpretation is equally flawed by the incomplete sample we possess.
...it is not possible to determine whether currently observable sedimentary processes - the basis of the uniformitarian axiom - are of the kind that will provide records in the future.	Uniformitarianism is geology's fundamental principle, but any empirical basis for it is called into question by an insufficient sample of the rock record.

Figure 1. Bailey and Smith's revolutionary ideas impact the foundations of modern stratigraphy. Six of their quotes⁶ are highlighted, along with a short explanation of their importance. Note that the axiomatic nature of uniformitarianism (bottom) means that no empirical sample is sufficient to prove it.

Thus, hiatuses are present at all scales; an inference of the fractal framework, supported by observation of the results of the LTI method in many wells.

This leads them to the idea that:

"A unifying fractal model ... would be consistent with the idea that the complex system that outputs the stratigraphic record—the 'Stratigraphy Machine' (Smith, 1994) operates in a condition of self-organized criticality."¹³

They sum up the revolutionary implications of their work by noting:

"For more than 200 years, hierarchical systems have seemed the natural basis for classifying strata. The geometrically fractal nature of the layering, without invalidating this approach, provides a quite different way of analyzing the record. It requires accepting the idea that classifications based on layer thickness (Bed

< Member < Formation < Group) select arbitrary class limits in what is actually a continuum of layer scales. Class dimensions will vary from section to section and from stratigrapher to stratigrapher for the simple reason that *there are no natural, fundamental, or expected thickness-based stratigraphic units* [emphasis in original]."¹⁴

Despite their protestation that their work does not "invalidate this approach", it seems clear that it at least challenges some fundamental assumptions of stratigraphy that date to its earliest days, as seen in the following six points.

Point 1: Deposition not continuous

Bailey described the 'Stratigraphy Machine' (SM) as the process, operating at all scales, by which forces of climate, tectonics, eustasy, and fluid dynamics drive the loading and

unloading of the crust, and the subsequent accumulation of rock waste as sediment. He states: “It is manifest, at all scales, by the tendency of the SM to self-organize to a critical condition, on the edge of chaos, in which the perturbations of the system may trigger unloading, i.e. induce the output of a local stratigraphic record.”¹⁵ Because it operates at all scales in a self-similar fashion, the record is a fractal manifestation of this machine.

Bailey and Smith argue that if the sedimentary record is fractal in nature and layering is an indication of chaotic changes in deposition over time, then it follows that “any record represents some small, but essentially immeasurable, fraction of the timespan within which it accumulated”.⁶ This “includes hiatuses on all scales, most of which go unnoticed”.⁶ That is why Ager’s (1973) observation of ‘more gap than record’ is so powerful. Early geologists thought they could ‘read’ history up a vertical section of tens to hundreds of metres of layered sediments. On a human scale, outcrops of that scale appeared to be the record of a lengthy history, based on the assumption of Lyellian rates.

But further study has set those outcrops in context. A 10 m outcrop seems insignificant in a basin with 10,000 m of sedimentary rock. Scale drives perception, and even a deep basin fades when compared to sediment accumulating through the depths of time. That is why geologists uniformly speak of anomalously *high* modern depositional rates from nearly all environments and of the relative incompleteness of the rock record.¹⁶ At these observed rates, the rock record should average *hundreds of kilometres* in thickness, not the ~2 km estimated today.¹⁷

Perhaps the most significant impact of their denial of continuous sedimentation affects the definition of stratigraphic type sections. The new GSSPs require the assumption of continuous deposition because:

“The requirement for continuous sedimentation across the GSSP level and the bracketing correlation markers is to avoid assigning a boundary to a known ‘gap’ in the geologic record. This requirement has generally eliminated most historical stratotypes for stages, which were commonly delimited by flooding or exposure surfaces and formally represent synthems.”¹⁸

As deposition is not continuous anywhere, and hiatuses of all scales (mostly unrecognized) exist, then geologists cannot know what sediment they are *not* seeing, and thus cannot be sure that the vertical succession actually represents the record they think it does. Ultimately, it calls into question every GSSP.¹⁹

Point 2: Sediment accumulation is not continuous

The second point is related to the first but at a larger scale. Bailey and Smith make the point that sediment accumulation is not continuous at *any* scale, if the rock record is geometrically fractal. They bring into the light an assumption that has long stayed in the shadows, calling continuity the “scale-related default assumption in stratigraphic analysis”.⁶ In other words, people assumed that the scale relative to human experience was the default setting of sedimentation and proceeded to build an entire stratigraphic template on that assumption.

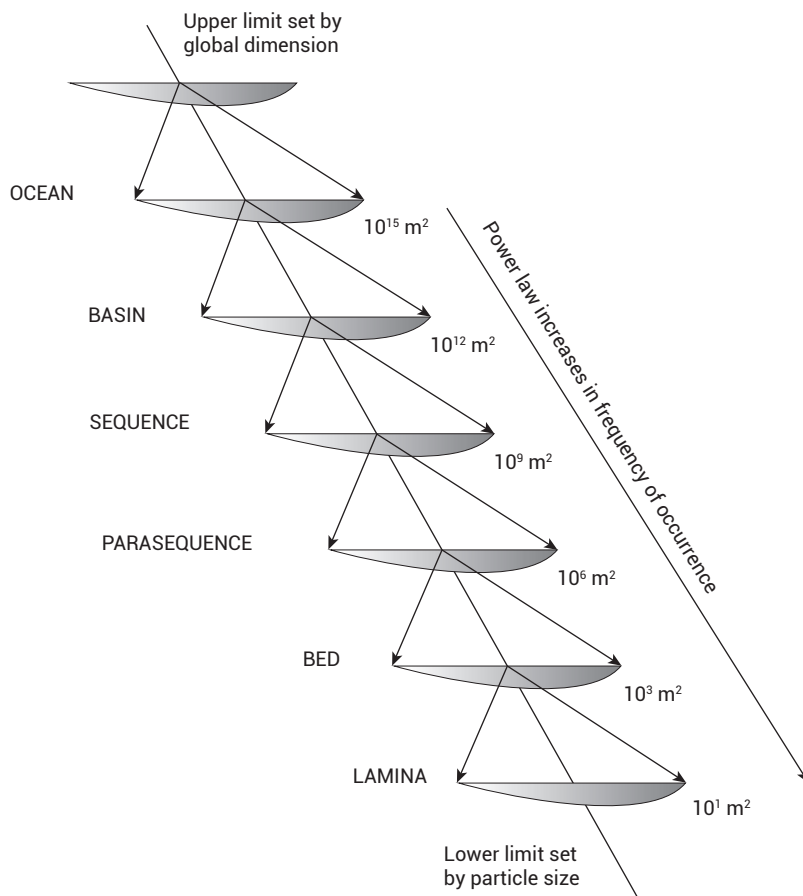


Figure 2. Fundamental geometric units of the sedimentary record are self-similar at the range of Earth scales. ‘Ocean’ represents the largest possible unit size. (After Bailey.⁹)

It is interesting here that Bailey and Smith refer to this default as “operationally convenient”.⁶ If assumptions drive methods and conclusions, one cannot help but wonder about the importance of data in such a system or what other ‘operationally convenient’ assumptions are made.

They note that the increasing subdivision of sequences in sequence stratigraphy into smaller and smaller collections of strata and gaps is a tacit admission that the continuity originally assumed in sequence stratigraphy does not exist. In a true hierarchical system, a geologist should eventually reach the scale of the ‘fundamental unit’. Sequence stratigraphers may argue instead that the ‘bounding surface’ (at any scale) is their fundamental unit but a ‘bounding surface’ is another word for a gap in the record—a representation that left *no* record other than erosional surfaces.

Point 3: Walther’s Law on the rocks

Walther’s Law is a crucial foundation of modern sedimentary analysis. I have previously noted:

“Facies are distinct groupings of sedimentary rocks, usually tied to depositional environments, lithology and sedimentary structures. Walther’s Law states that, as long as sedimentation is continuous, the vertical succession of facies represents the lateral distribution of facies at the time of deposition.”¹⁹

Given the ubiquitous presence of hiatuses at every scale of the rock record, Bailey and Smith recognize that apparent facies associations in a given vertical sequence may have no real historical lateral relationship to each other because of the unknown time represented by intervening hiatuses. In that case, paleogeographic maps, facies maps, and other interpretations built on the assumption of horizontal facies associations could all be invalid. As they note, “the sequential relationships of the strata are real enough, but the record, which is fragmentary on all scales, provides only rare glimpses of the environmental history”.⁶

If that is truly the case, then environmental interpretations, which are a major part of modern geological analysis, would all be suspect to the extent they assume Walther’s Law.

Point 4: Accumulation rates unique to time and place

Prior to the application of modern methods of biostratigraphy, radiometric dating, cyclostratigraphy, and magnetostratigraphy, geologists made field approximations of durations based on stratal thicknesses. During the heyday of Lyellian gradualism this was done explicitly; today it is done on a less conscious level. Geologists see a thin layer and think ‘short time’; they see a thick layer and think the contrary. Even when dates are available to demonstrate the great age

of a thin layer or the rapid emplacement of a thick one, the tendency remains embedded, perhaps simply an illustration of how scale affects our thinking.

Bailey and Smith note that this tendency is without support in reality.⁶ They cite the power law decrease of accumulation rate with age,²⁰ showing (contrary to the supposedly guiding principle of actualism)²¹ that not only do modern rates have little to do with the volume or thickness of ancient strata, but one set of rocks of one age in one location cannot be related in this fashion to another set of rocks in another location.

The idea that rocks can be correlated on a global scale by assigning them a specific time of emplacement, and correlating the *time* rather than the rock, is perhaps the fundamental assumption of the geological timescale.²² If Bailey and Smith are correct, then support for that assumption must be questioned.

Point 5: Rock record does not represent the past

From Steno on, people have viewed stratigraphy as being a *record*. Whether showing the effects of the Flood or of billions of years of gradualist processes, geologists have all assumed the rocks represent history. Cuvier was famous for his analogy between strata and antiquities—both were forensic evidence of the past.²³

But if the sedimentary record at any one location is nothing more than a collection of ‘frozen accidents’ lost in gaps of all scales, that assumption appears to be gratuitous. If most of the supposed history is represented by nothing, then most of the time is ‘dead time’, not ‘deep time’, and our grasp on history is tenuous at best. The empirical data needed for historical confidence are called into question, much less that needed for scientific certainty.

This is much more damaging to secular geologists than to creationists because they insist on a worldview with a positivist epistemology—one that sneers at the historical testimony of the Bible and insists on ‘hard data’. Unfortunately, it turns out that their ‘hard data’ are nothing more than a house of cards—the major difference being that a house of cards has a more solid framework and a greater ratio of substance to thin air! As Bailey and Smith conclude: “the record may not be representative of this history ...”,⁶ echoing Bailey’s earlier statement that “It is the human reference frame that decides what is stratigraphic and what is ephemeral.”²⁴

Point 6: Last bastion of uniformitarianism crumbles

Uniformitarianism has always been the bedrock of modern geology. As late as 1968, Challinor called it “the fundamental

principle of geology”.²⁵ However, it was at that time that cracks began to appear in the concept. Work by Hooymaas²⁶ and Gould²⁷ spurred geologists to re-examine the theoretical and philosophical basis of their ‘fundamental principle’ and they discovered that they could not even define the term.^{28,29} Furthermore, empirical problems were becoming evident and Hutton and Lyell were morphing from martyrs for science to millstones around the neck of geology, especially after the fiasco of decades of blind uniformitarian opposition to the mounting evidence for the Lake Missoula Flood.³⁰

Over the next two decades, geologists brilliantly used one problem to solve the other. They claimed that ‘uniformitarianism’ was not inherently equivocal but had four distinct meanings.³¹ Using this ‘four-definition solution’, they were able to pin Hutton and Lyell to two of them, and then excise Hutton’s deistic eternalism and Lyell’s extreme gradualism, leaving the term intact, with acknowledged definitions of: (1) general uniformity and (2) Gould’s ‘methodological uniformitarianism’, which spurred a revival in the ironically prior but long-ignored term ‘actualism’. As neocatastrophism waxed in popularity, this version of uniformitarianism became embedded—even the geological dictionaries adjusted their definitions to reflect the new reality.³¹

But, as Bailey and Smith note, if “it is not possible to determine whether currently observable sedimentary processes ... are of the kind that will provide records in the future ...”,⁶ then neither can we know if they are the ones operating in the past and represented by the rock record. If correct, then the methodological uniformitarianism that restricts interpretation of past processes to the reservoir of those observed in the present is no longer tenable.

This leaves the general principle of science as the only uniformity. Since it pre-dated geology, there is no distinct principle that would prevent geology from being classified as a derivative part of physics, etc. Absent any convincing rationale for its ‘fundamental principle’, historical geology, which many consider to be the one true distinctive of geology as an independent science, has no solid basis.³²

Meaning for diluvial geology

If the sedimentary rock record is fractal, with layering and gaps characteristically found at all scales, there are a number of implications for diluvial geology. Two, in particular, are important. First, the six points discussed above provide a skeptical *secular* evaluation of the past two centuries of stratigraphy, especially the assumptions of uniformitarianism and a knowable deep time. It cannot be emphasized enough that creationists have an inherent advantage in their worldview because they interpret empirical data with a completely different worldview. They frame history in the context of biblical revelation. When one must rely on only

empirical evidence to support one’s natural history, and if the implications of one’s own view of the rock record lead to the conclusion that much evidence is lacking, then the natural superiority of the biblical approach becomes clear.

Correspondingly, that implies that creationists who advocate the use of the chronostratigraphic timescale as an *empirical* explanation of the rock record (and a basis for Flood models) should exercise greater caution. The clear inference of Bailey and Smith is that the timescale and its stratigraphic roots in the rock record result from unwarranted assumptions about the nature of the rocks and how they are perceived by people. Ironically, it is their *empirical* LTI analysis that reveals those assumptions, especially those deeper ones regarding the relationship of scale to reality. It reinforces the idea that the timescale is a conceptual template imposed on the rocks, not an empirical conclusion flowing from them.

The second relevant issue for creationists is the need to step away from the assumptions and methods of the early 19th century and see the rocks from a more up-to-date perspective. Bailey and Smith demonstrate that the application of statistical methods to measurements made from natural gamma ray logs yield information about the rocks undreamed of by Lyell, Cuvier, or any of the 19th century ‘fathers’ of the science. One way of seeing the meaning of their work is to see it as the liberation of sedimentology from stratigraphy. This is pertinent for Flood geology because today’s methods allow a more rigorous examination of the Flood from a sedimentological/hydrodynamic point of view.³³ If the movement of water occurred in similar ways across a wide range of scales, then the self-similarity of sedimentary layering and hiatuses may have been a natural outgrowth of the Flood and a way to help us understand it.

The major difference between diluvial geology and the ideas of Bailey and Smith is that layer boundaries may represent near-instantaneous changes in flow conditions or sedimentary sourcing, rather than long periods of time. If that is the case, there is more ‘record than gap’, and stratigraphy can be pursued optimistically, unlike the realistic pessimism that believes there is very little record remaining. Modern examples of mass flows, hurricane deposits,³⁴ and lahars show us that sedimentary layering, which Bailey and Smith see as fundamental to stratigraphy, can be the result of variations in transport, not vast amounts of time.

Bailey and Smith draw correct inferences from the set of assumptions they have been dealt. Their pessimism over the possibility of stratigraphic analysis as it has been done for many years, and their fear that there is vastly more gap than record because of the fractal nature of hiatuses, opens the door for diluvial geology to examine the possibility that the apparent vertical progressions in strata are, in fact, real, but are the result of large-scale rapid deposition.

Conclusions

As geologists continue to examine the rock record, those willing to follow the data, such as Bailey and Smith, are finding that the old verities are evaporating in the light of empirical analysis. Their work may represent the beginning of a paradigm shift in stratigraphy. For this reason, creationists should be aware of it and recognize the opportunities it presents, both in critiquing the old stratigraphy and in developing our own unique approach to the rock record.

References

- Bailey, R.J. and Smith, D.G., Scaling in stratigraphic data series: implications for practical stratigraphy, *First Break* **10**:57–66, 2010.
- Smith, D.G., Bailey, R.J., Burgess, P. and Fraser, A. (Eds.), *Strata and Time*, Geological Society, London, Special Publication 404, 2015.
- Miall, A.D., Updating uniformitarianism: stratigraphy as just a set of ‘frozen accidents’; in: Smith *et al.*, ref. 2, p. 13.
- An example is the work of Guy Berthault. See also, Reed, J.K. and Froede Jr, C.R., Provenance studies of clastic sediments and their role in a hydrodynamic interpretation of the Genesis Flood, *CRSQ* **46**(2):109–117, 2009.
- Bailey and Smith, ref. 1, p. 59.
- Bailey and Smith, ref. 1, p. 64.
- Bailey, R.J., Review: stratigraphy, meta-stratigraphy, and chaos, *Terra Nova* **10**: 222–230, 1998.
- See figure 3 of Bailey, ref. 7.
- Bailey, ref. 7, modified from his figure 1. He later states: “The stratigraphic record is both simple and self-similar in character. At all scales of observation from the major basin to the solitary lamina it shows the repetition of a simple lenticular geometry and a limited range of lithological attributes” (p. 228).
- Bailey, R.J. and Smith, D.G., Quantitative evidence for the fractal nature of the stratigraphic record: results and implications, *Proc. Geol. Assoc.* **116**: 129–138, 2005.
- Bailey, R.J. and Smith, D.G., Quantitative tests for stratigraphic cyclicity, *Geol. J.* **43**:431–446, 2008.
- Bailey and Smith, ref. 1, p. 60.
- Bailey and Smith, ref. 1, p. 62.
- Bailey and Smith, ref. 1, p. 63.
- Bailey, ref. 7, p. 228.
- Reed, J.K. and Oard, M.J., Not enough rocks: the sedimentary record and Earth’s past, *CRSQ*, (in preparation).
- E.g. Ronov, A.B., *The Earth’s Sedimentary Shell*, American Geology Institute Reprint Series 5, Falls Church, VA, 1983.
- Gradstein, F.M., Ogg, J.G. and Smith, A.G., Chronostratigraphy: linking time and rock; in: Gradstein, F.M., Ogg, J.G. and Smith, A.G. (Eds.), *A Geologic Time Scale 2004*, Cambridge University Press, Cambridge, UK, p. 23, 2004.
- Reed, J.K., *Rocks Aren’t Clocks*, Creation Book Publishers, Powder Springs, GA, 2013.
- Cf., Saddler, P.M., The influence of hiatuses on sediment accumulation rates, *GeoResearch Forum* **5**:15–40, 1999.
- Reed, J.K., Untangling uniformitarianism, level II: actualism in crisis, *Answers Res. J.* **4**:203–215, 2011.
- Reed, J.K., Toppling the timescale, part II: unearthing the cornerstone, *CRSQ* **44**(4): 256–263, 2008.
- Reed, J.K., Cuvier’s analogy and its consequences: forensics vs. testimony as historical evidence, *J. Creation* **22**(3):115–120, 2008.
- Bailey, ref. 7, p. 228.
- Challinor, J., Uniformitarianism—the fundamental principle of geology, *XXIII Int. Geol. Cong.* **13**:331–343.
- Hooykaas, R., *The Principle of Uniformity in Geology, Biology, and Theology*, 2nd impression, E.J. Brill, London, 1963.
- Gould, S.J., Is uniformitarianism necessary? *Amer. J. Sci.* **263**:223–228, 1965.
- Albritton, C.C., Jr (Ed.), *Uniformity and Simplicity: A symposium on the Principle of the Uniformity of Nature*, Geol. Soc. of Amer. Special Paper 89, New York, 1967.
- Shea, J.H., Twelve fallacies of uniformitarianism, *Geology* **10**:455–460, 1982.
- Baker, V.R., Catastrophism and uniformitarianism: logical roots and current relevance in geology: in: Blundell, D.J. and Scott, A.C. (Eds.), *Lyell: the past is the key to the present*, Special Publication 143, Geological Society, London, pp. 171–182, 1998.
- Reed, J.K., Untangling uniformitarianism, level I: a quest for clarity, *Answers Res. J.* **3**:37–59, 2010.
- Kleinhans, M.G. and Buskes, C.J., *Philosophy of Earth Science: Just Sloppy Physics?* Nijmegen, Netherlands, Netherlands Centre for River Research, 2002, argue the affirmative of the reduction of geology. Cleland, C.E., Common cause explanation and the search for the smoking gun; in: Baker, V.R. (Ed.), *Rethinking the Fabric of Geology*, Geological Society of America, Special Paper 502, Boulder, Colorado, pp. 1–9, 2013, argues for a distinct set of historical sciences.
- As shown in the work of Guy Berthault and Alexander Lalomov, e.g. Berthault, G., Time required for sedimentation contradicts the evolutionary hypothesis, *CRSQ* **46**(4):261–269, 2010.
- Barnhart, W.R., Hurricane Katrina splay deposits: hydrodynamic constraints on hyperconcentrated sedimentation and implications for the rock record, *CRSQ* **48**(2):123–146, 2011.

John K. Reed earned B.S., M.S., and Ph.D. degrees in geology. He worked for several decades as a professional geologist in industry and academia. In 1998, John became the geology editor of the Creation Research Society Quarterly, and was subsequently elected to the CRS Board of Directors. He has written and edited numerous books and articles about Creation and natural history.

Reversible autopoiesis—a foundational design principle for life's survival

Alex Williams

As a contribution to a general theory of living systems I here identify a foundational design principle that provides robust survival options under adverse conditions of resource limitation—*reversible autopoiesis*. Autopoiesis is the continuous process of 'self-making' that allows organisms to grow, maintain, and repair themselves, and to periodically reproduce themselves. But the technology required for maintaining and repairing cells contains within itself the ability to degrade and recycle everything that normal metabolism manufactures; otherwise the cell would rapidly become dysfunctional through waste accumulation. Because the bodies of all organisms are originally *made* out of food and water from the beginning, they can therefore *unmake* themselves in a controlled manner to *produce* food and water again in times of special need. All organisms appear to use the same strategy—focusing their efforts upon energy production to keep the protein 'wheels of life' turning. To achieve this they mobilize stored reserves, reduce their metabolic rate and their cell population numbers, and conserve essential vitamins and minerals together with the molecular mechanisms enabling recovery when conditions improve. This design principle is foundational in that it is a logical consequence of how life *must* be made from the beginning—otherwise it doesn't work.

As a biologist and philosopher of science Carol Cleland has recognized that we need a general theory of living systems before we can hope to explain life's origin.¹ One approach is to develop a description of life's underlying design principles. However, Cleland warns that we should not mistake the signs of life to necessarily be the essentials of life, and she is skeptical of contemporary theories of origin.² Creationists have identified numerous functional,³ and aesthetic⁴ design principles in living organisms, and in this article I identify one that promotes survival in the face of resource limitation—*reversible autopoiesis*. This principle is foundational in that it is a necessary and logical consequence of how life *must* be made from the beginning, and it provides robustly sustainable functionality during periods of starvation.

Autopoiesis

In 1972 Chilean biologists Maturana and Varela introduced the term *autopoiesis* to demonstrate that life's unique ability to periodically reproduce itself flows out of a more generalized and continuous process of *self-making*.⁵ Philosopher Evan Thompson highlighted the importance of its recursive nature—every molecular reaction in the system is generated by the same system that the molecular reactions produce.⁶ Because living organisms have this ability to routinely 'make themselves' out of nothing more than food and water, this article demonstrates how they can also reverse that process and *unmake* themselves to *produce* food and water again in times of need.

Biochemistry textbooks typically provide all the information necessary to understand how the cell makes everything it needs out of energy and nutrient sources. There will also be descriptions of how these cell commodities are degraded again, sometimes by a simple reversal of the synthetic process and sometimes via a somewhat different route. The point I want to make is that *all* the machinery necessary to both make (in their entirety) and degrade (in their entirety) *all* the cell components is present in *every* normal living cell, and it *must* be so, otherwise waste products would accumulate and destroy cell function. And it must be so from the beginning, otherwise the first generation of living cells would have died from toxic waste accumulation. The inescapable consequence is that autopoiesis is, by definition, reversible, and this situation has logical consequences for life's robustness in the face of resource limitation. This fundamental design principle—that life is *reversibly* made from food and water—becomes especially obvious in a comparison between living organisms and robots.

Robots versus cells

It is possible with current technology to make robots that emulate a wide range of life-like activities, but the crucial differences in design principles emerge most clearly when they experience stress, especially starvation. When a robot runs out of fuel it stops working. When a living organism runs out of fuel (food, water) autopoiesis goes into reverse and it begins to *unmake* itself to *produce* food and water to sustain itself until conditions improve. Robots are usually made out of plastic and metal and so have to use something entirely

different—electricity, for example—as fuel. Until robots are created that can make themselves out of the same fuel they need to run on they will never catch up with the innate abilities of living organisms. Crucially, such robots will probably need to be made largely out of water, as cells are.

Humans die within a few days without water, or even within a few hours under extreme conditions (e.g. a child left in a hot car, or an athlete exercising too hard in hot weather).⁷ But some creatures can live their whole lives without drinking water. Australian wild koalas can extract all the water they need during digestion of their food—oil-rich eucalyptus leaves.⁸ The leaves contain some water, and metabolic breakdown of the oils and other materials produces enough extra ‘metabolic water’ to meet their needs. Their sedentary lifestyle reduces energy and water use, and tree-hugging reduces body temperature (and thus water loss) during heat-waves.⁹ During bush fires, however, they will run to safety and eagerly seek water to drink.¹⁰ In humans, metabolic water yields for the most common body materials are: 107.1 g of water from each 100 g of fat; 55.1 g of water from 100 g of starch; and 41.3 g of water from 100 g of protein.¹¹

Reptiles are notorious for going long periods (years, in some cases) without eating food, as do creatures that undergo seasonal hibernation or dormancy. Those that live underground in caves (troglotauna) and aquifers (stygo fauna) can survive long periods (10 years in the case of the European olm, a salamander) without food.¹² An average healthy human adult can survive for about 2–3 months without food if enough water is available, but a hunger-striker in India was still alive after 116 days.¹³ When robots run *low* on fuel they can *intelligently* return to a fuel source, but when they run *out* of fuel they stop dead!

Autopoiesis in reverse

The most detailed information we have on reversible autopoiesis comes from the study of humans, notably in medicine where patients may suffer nutritional stress associated with diseased or traumatized states. Famines and war zones have also produced large numbers of victims subjected to starvation and/or near-starvation over long periods of time. Anorexia nervosa is now a common cause of starvation, and ultramarathon running puts healthy human bodies under extreme nutritional stress for days at a time. Information that follows has been drawn largely from a web-based resource maintained by Duke University,¹⁴ except where other sources are cited.

Whole-body effects of starvation

A healthy 70 kg human consists of about 38.5 kg (55%) water and 31.5 kg (45%) dry solids. Of the solids about 28 kg

(40%) is organic matter and 3.5 kg (5%) minerals. The organic component includes about 6 kg of protein, of which 4 kg is in muscle and 1 kg in hemoglobin. The remainder is spread throughout the body, including 25–35 g as blood serum proteins (albumin and globulins).

A healthy person can fast (no food but with adequate water) for about three days without suffering significant physical or mental defects. Continued fasting up to 10 days will produce physical and mental symptoms including fatigue, impaired response times and loss of concentration. Blood volume reduces rapidly and the body’s fluid balance turns negative as breakdown products (largely urea) are excreted at a greater rate than normal. Body weight reduces almost linearly by about 0.7 kg per day over these 10 days.¹⁵

Under longer-term starvation in adults virtually all soft tissues lose mass as they are deconstructed in a staged manner to maintain essential systems. The worst-affected adult survivors in European concentration camps after World War II looked like skeletons covered with skin. Similar effects were documented in Asian prisoner of war camps.¹⁶ In children, chronic malnutrition often results in disfigurement of the body.¹⁷ Adults generally survive longer than children during famine, both because they have larger body reserves to draw upon, but also because their systems are mature. Surprisingly, vitamin deficiencies do not usually show up in starving adults,¹⁵ unless there is complication from disease. On the Thai-Burma railway the workers were sparingly fed mainly on white rice, which lacks, among other things, vitamin B1 and niacin, and this caused beriberi and pellagra in those who suffered dysentery. It was reported: “Their continuous passing of stools caused dehydration and drained them of vitamins essential to their survival.”¹⁸ The implication is that normal bowel motions would not have drained their vitamin stores. The starving, but otherwise healthy, adult body appears to conserve vitamins and minerals while consuming other body tissues in a controlled manner to produce essential energy. This finding is supported by research on ultramarathon runners (see below).

Psychological factors may have been important in explaining the large difference in survival rates on the Thai-Burma railway. Among Europe’s Allied Powers (British, Dutch, Australians, Americans)—i.e. those who were engaging the war and believed in the cause they were fighting for—the survival rate was 80%. Among the usually smaller-bodied Burmese and Malays—who were mostly unlucky victims of foreign occupation—the survival rate was only 45–55%.¹⁹ The amount of time these people were subjected to near-starvation and forced labour varied, but can be bracketed by the fall of Singapore in February 1942, when more than 100,000 Allied troops were captured, and the end of the war in the Pacific in August 1945—three and half years.

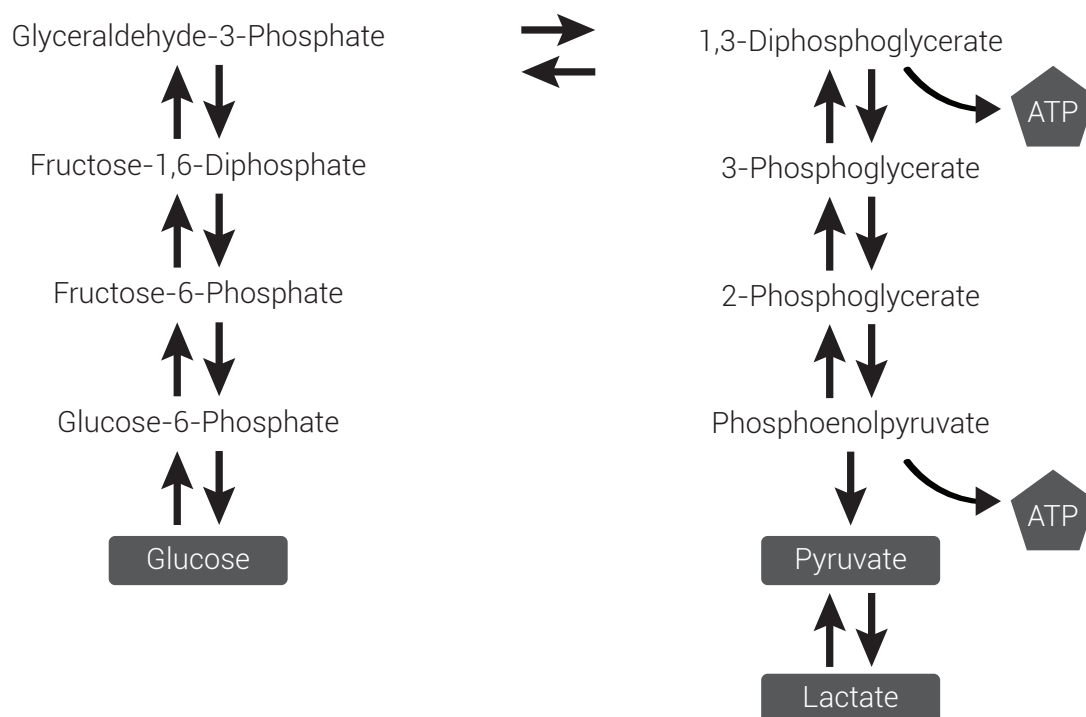


Figure 1. Glycolysis is the normal aerobic pathway for oxidative release of glucose energy as ATP. Glucose (lower left) is broken down via a series of mostly reversible reactions to produce pyruvate and lactate (lower right). This pathway can work in reverse (with three extra enzymes) to produce glucose.

Physiological effects of starvation

The brain and the central nervous system are the most critical organs that depend on glucose as their primary energy source, normally completely metabolizing 100–150 g per day to carbon dioxide and water. Irreversible brain damage can occur if glucose deprivation persists for as little as 10–20 minutes. Other glucose-sensitive tissues include renal medulla, bone marrow, red blood cells, and peripheral nerves.¹⁴ When these tissues metabolize glucose they produce lactate and pyruvate, which are useful carbon sources that can be regenerated back into glucose via a process called *gluconeogenesis*.

The initial metabolic response to starvation does not differ physiologically from the post-absorptive phase in between meals in a well-nourished person. The body relies first upon the dietary glucose supplied by food, then excess glucose previously stored in the liver as glycogen is reduced back to glucose, then it switches to oxidation of fatty acids; proteins are initially conserved because they are not stored in the body and their loss means loss of cell function.²⁰ Once the glycogen store of about 120 g is used up, the body must revert to gluconeogenesis, which mostly utilizes glutamine, alanine, and glycerol to produce glucose in the liver, kidney, and intestine.¹⁴ In parallel, production of ketones such as 3-hydroxybutyrate and acetoacetate is initiated in the liver. Ketones can directly supply energy to the brain because they

are among the few substances that can cross the blood-brain barrier.

“Starvation ensues when protein remains the only source of energy for the body. The amount of glucose usually utilized by the body is reduced to a minimum, with the metabolic rate of the cells being decreased significantly to allow for the subsistence of the organism as a whole. Individuals who suffer from chronic starvation adapt, displaying similar basal metabolic rates as healthy individuals when adjusted for fat-free body mass since the visceral organs with the highest metabolic rates such as the brain and the kidneys remain relatively unaffected.”²¹

Adults can recover quite well from this state with appropriate treatment, but children suffer vitamin and nutrient deficiencies that cause stunted growth and development, poor bone quality, and earlier onset of diseases such as osteoporosis.²¹

Important metabolic pathways for survival

Because most of the biochemical steps in normal metabolic cycles are reversible they provide ready-made pathways for regeneration of glucose from non-carbohydrate sources. The normal glucose breakdown pathway (glycolysis) is shown in figure 1, and requires enzymes that drive the forward process from left to right. Three extra enzymes are required to turn the pathway backwards into gluconeogenesis:

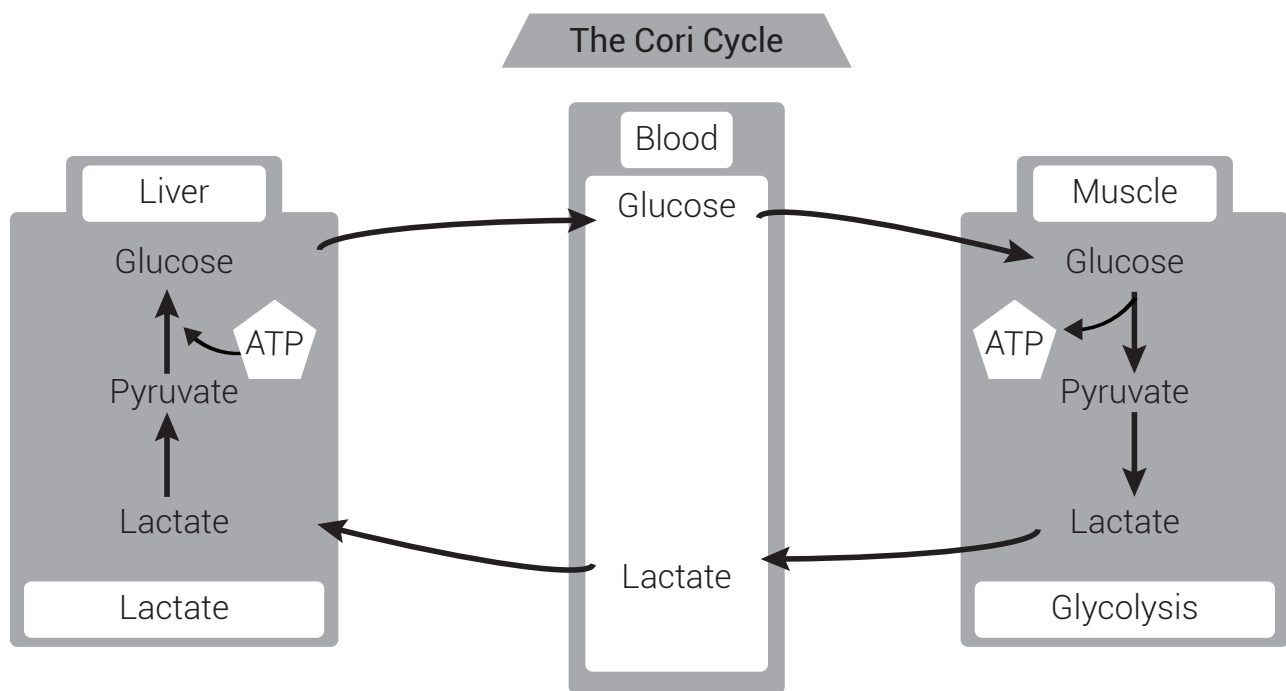


Figure 2. Cori cycle (lactic acid cycle). Muscles (right) normally use glucose to produce energy (ATP) via glycolysis. The lactate end-product is carried via the blood (centre) to the liver (left) where it is converted back into glucose via gluconeogenesis, which requires some ATP as input. Glucose is then exported back to the muscles via the bloodstream.

"The first is a specific phosphatase capable of converting fructose diphosphate to fructose 6-phosphate. ... Phosphoenolpyruvate carboxykinase catalyzes the conversion of oxaloacetate to phosphoenolpyruvate. This step permits oxaloacetate, and any substance that can be transformed into oxaloacetate, such as aspartate, to serve as substrates for gluconeogenesis. Finally, pyruvate carboxylase catalyzes conversion of pyruvate to oxaloacetate, thereby allowing lactate, alanine, serine, and similar substances to enter gluconeogenesis upon their conversion into pyruvate."¹⁴

Lactate is the normal end-product of glucose oxidation in muscles and it can be recycled back to glucose through the Cori cycle (lactic acid cycle, figure 2) in the liver and kidney, using energy produced by fatty acid oxidation. Pyruvate can undergo oxidation in the Krebs cycle (citric acid cycle) inside mitochondria in muscle cells to directly resupply them with ATP, or it can be transported in the bloodstream to undergo gluconeogenesis in the liver (figure 2).

Humans depend mainly on gluconeogenesis in the liver to meet energy requirements early in starvation, but in later stages the kidneys provide up to half of the total. When muscle protein breaks down it produces a range of amino acids, one of which is glutamine, and several other amino acids are converted into glutamine by a process called *transamination*. Glutamine then becomes the major amino acid in the bloodstream and it enters the gluconeogenesis

pathway in the kidney (figure 3). The main nitrogenous by-product is ammonia (NH_3) which is partly excreted in the urine and partly recycled back into making new proteins.

The Cahill cycle (figure 4) provides a major pathway for gluconeogenesis in the liver, where its main amino acid substrate is alanine.²²

"In muscle, pyruvate is generated during anaerobic breakdown of glucose. The nitrogen moiety of branched-chain amino acids (valine, leucine, and isoleucine) is transaminated to pyruvate, forming alanine ... [plus] additional ATP for local use. The alanine released from muscle is taken up by the liver, where the nitrogen is split off. The resultant pyruvate is recycled to glucose via gluconeogenesis. Most of the nitrogen is excreted in the urine as urea; however, some is re-utilized in protein synthesis."¹⁴

"Early in starvation, approximately 75 g of body protein and 160 g of adipose tissue are metabolized each day All [body] proteins are utilized, ... [and blood s]erum albumin is used in the ratio of 1 g albumin per 30 g tissue protein lost. The most clinically evident protein loss is from skeletal muscles. [Fat breakdown] releases free fatty acids and glycerol. Although free fatty acids cannot participate directly in gluconeogenesis, they can serve as an energy source in the liver for the Cori cycle and generate acetyl-CoA, which enhances the conversion of pyruvate to

oxaloacetate. Glycerol is readily converted to glucose.”¹⁴

Prolonged starvation results in a lowered metabolic rate, which results in “diminished muscle activity, increased sleep, and decreased core temperature.”¹⁴ The need for gluconeogenesis diminishes because the central nervous system changes over from using glucose to using ketones as its primary energy source. The stimulus for this change seems to be a rise in serum levels of D-β-hydroxybutyrate,²³ a product of ketone metabolism.²⁴ “Protein catabolism [breakdown] falls from 75 to 20 g/day, with a marked decrease in excretion of urea nitrogen to 3–5 g/day.”¹⁴

When the body has reached its lowest level of adaptation to starvation, energy comes mostly (60%) from fat metabolism (cell membranes begin to disintegrate), 25% from ketone metabolism, 10% from conversion of free fatty acids into ketones, and 5% from protein breakdown.¹⁴ Ketones in urine are a signal of prolonged starvation.¹⁴ Death usually ensues after 60 to 70 days without food.

Recovery from starvation

Recovery from 10-day starvation is generally rapid from day one onwards, and after six weeks the subjects are largely back to normal weight.¹⁵ Recovery from longer starvation is dependent on body reserves and the severity of caloric deficit. Some survivors of European concentration camps were so weak they could not eat. In such cases alternative energy sources are required. Some survivors who could not eat but were given sugar cubes to suck did recover, but many who were given army rations died because their depleted bodies could not cope with rich food. Other survivors fared much better for various reasons.²⁵

United Nations experience with famine relief highlights the special needs of children, pregnant women, and breast-feeding mothers.²⁶ In the early stages of famine, human lactation is relatively unaffected so breast-feeding is an important built-in method of protecting offspring. Famine-relief foods for children and pregnant and lactating women need to be rich in calories, protein, and vitamins. Infectious disease also complicates famine deaths, especially among children, so maternal and child healthcare is required.

Once an adult victim of starvation has had adequate energy resupply, normal

“... total body protein synthesis is usually restored at a rate of 18 to 30 g/day. ... During recovery, essential

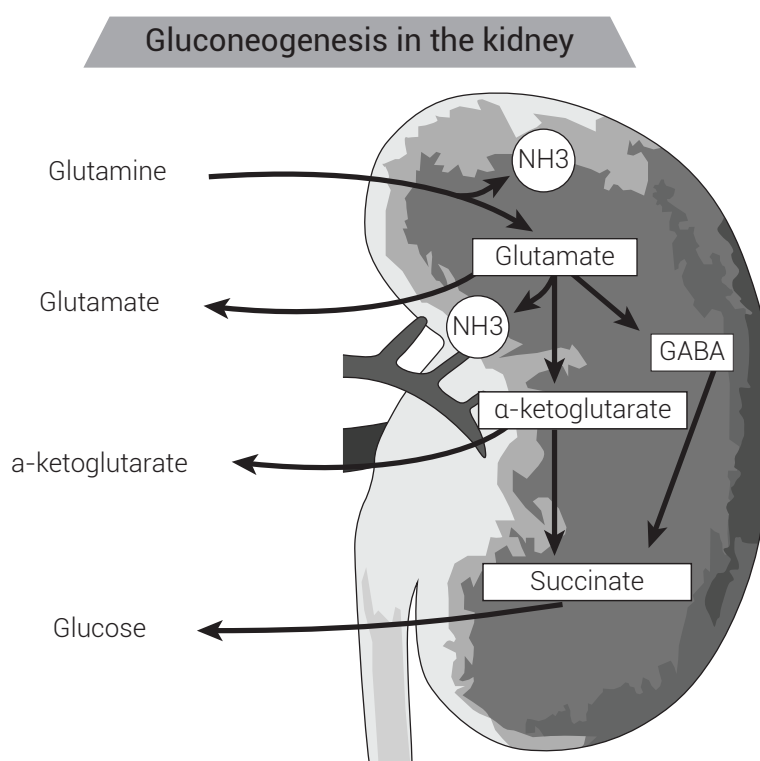


Figure 3. Glutamine is a major substrate for gluconeogenesis in the kidney, particularly in the later stages of starvation.

amino acid, total protein, and caloric requirements are all greater than normal. After nitrogen [i.e. protein] losses have been restored, fat is gained almost exclusively for several weeks or months until the normal body fat stores are regained. In this phase, nitrogen balance is zero, although carbon balance is positive.”¹⁴

Starvation affects adult bone much less than soft tissues. Bone morphology remains largely intact, but bone density and quality may decline. Animals well adapted to annual starvation (e.g. hibernating bears) recover well, but others, such as moose, that are not adapted to starvation because they migrate to find food, are prone to becoming ill and/or lame through osteoporosis. Chinese women 65 and older who had experienced famine at some time in their lives showed a 5% increase in the frequency of osteopenia and osteoporosis compared with those who had not been so affected. Female survivors of the Holocaust who were 60 and older, compared with a contemporary control group of European Jewish women, showed a 200% increase in the frequency of osteoporosis.²¹ Child Holocaust survivors (under 16 at the end of World War II) suffered the highest incidence of osteoporosis and osteopenia in later life. Anorexia nervosa sufferers have demonstrated similar effects.²¹

Long-term complete recovery is never certain. Symptoms observed in surviving prisoners of the war in Asia 10 years after their release included easy fatigability, profuse sweating

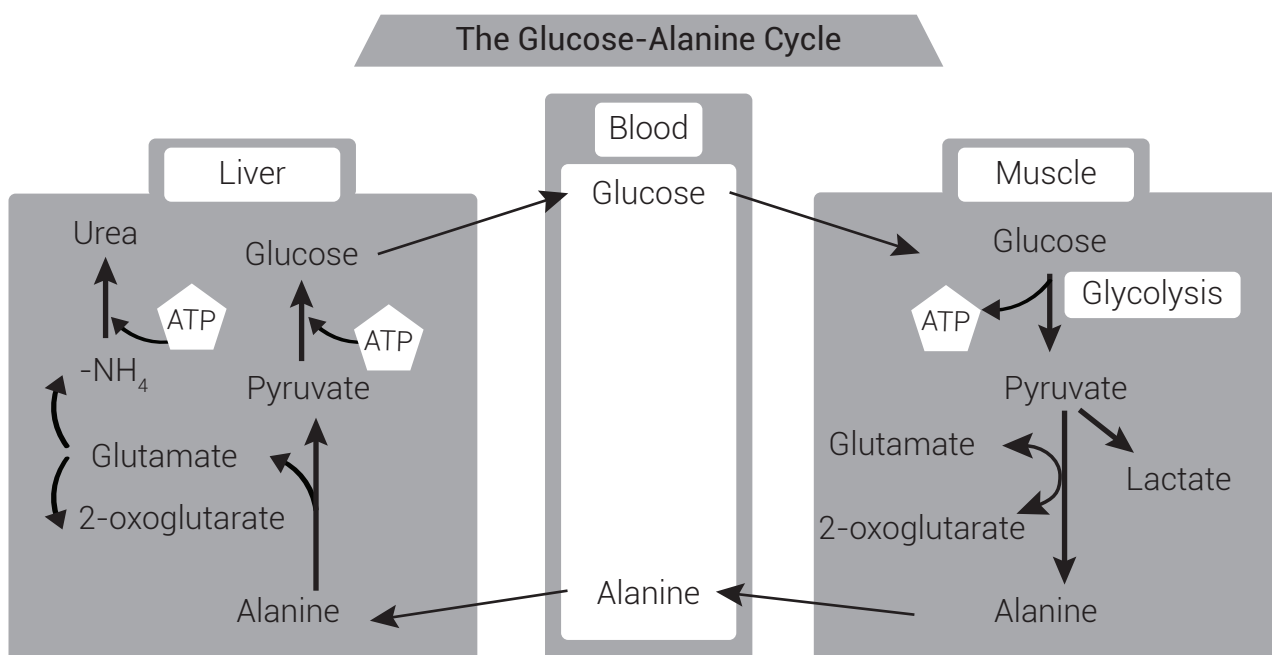


Figure 4. The Cahill (glucose-alanine) cycle, a major source of gluconeogenesis in the liver

for no apparent reason, numbness and cramps in calf muscles, loss of ambition, poor vision, oedema, dyspnoea on even the slightest exertion, depression, tachycardia, anorexia, nausea, restlessness, irritability, and insomnia.¹⁵ Many, however, recovered sufficiently to live long and fruitful lives.

Evidence from ultramarathon running

The effects of starvation and recovery in the human body reported above are confirmed in the literature on ultramarathon running. An ultramarathon course is longer than a standard marathon of 42 km and includes the 100 km course, double marathons, 24-hour races, and multi-day races of 1,600 km or longer.²⁷

Endurance athletes who have a short recovery time (8–24 hours) before the next event need only eat optimal amounts of carbohydrate and protein.²⁸ The carbohydrate replenishes glycogen stores in the muscles, with any excess going to fat storage, and the protein is used in rebuilding depleted muscles. Vitamin and mineral supplements are not necessary as the body can conserve these components while using up carbohydrates, fats and proteins in gluconeogenesis. Regular rehydration is essential, but the need for electrolyte supplements varies among individuals.²⁹ Some women may need calcium, iron, and/or vitamin D supplementation.³⁰

While post-event dietary needs are relatively uniform, the preparation required before an ultramarathon is extremely variable, largely due to individual differences in physiology, culture, and taste. Ultramarathon runner Mark Woolley (Ph.D. in physical chemistry) argues that because the body

uses carbohydrate reserves first, but it gains more energy from fat metabolism, he trains on a low-carbohydrate and moderately high-fat diet. This, he believes, trains his body to make more general use of fat metabolism. On race day he eats a high-carbohydrate diet up to the 12-hour point in the race then switches to sandwiches soaked in olive oil.³¹ Supervising doctors say that you should do whatever works for you.²⁹

Microbial responses to starvation

Many microbes are well adapted to boom-and-bust environments. Gut microbes in warm-blooded vertebrates can feast on a regular food supply at optimal body temperatures (e.g. 37°C in humans), but when passed out in excreta conditions can change dramatically. Shallow lakes and floodplains in monsoonal climates are likewise subject to a yearly cycle of lush growth in the wet season and high-temperature drought in the dry season so their microbes must have a variety of strategies for survival.³² Marine microbes in the varied habitats of shallow seas in arid regions are also subject to extreme environmental fluctuations.³³

Bacteria display a characteristic *stringent response* in reaction to various stress conditions, including “amino-acid starvation, fatty acid limitation, iron limitation, heat shock, and others”.³⁴ The stringent response is communicated throughout the cell by a special signalling molecule called an *alarmone*, “which modulates transcription of up to a third of all genes in the cell. This in turn causes the cell to divert

resources away from growth and cell division” and towards energy production.³¹

Like higher organisms, the gut microbe *Escherichia coli* survives famine by lowering its metabolic activity to conserve energy but many individuals die. A comparative utilization study of 95 different energy substrates by starved versus non-starved cultures of a toxic *E. coli* strain from New Zealand cattle found that usage of nine substrates, including fructose-6-phosphate, glucose-1-phosphate, pyruvic acid, and thymidine, was not affected by starvation.³⁵ These substrates are commonly found in forage plants recently ingested by ruminants and show that the starved microbes had conserved their ability to detect when conditions improve so they can rapidly re-establish their population numbers. Survival outside the host depends strongly upon temperature. At 15°C (summer in New Zealand) 97% of the populations died in the first three weeks on low-nutrient supplies, but most of the remainder persisted throughout the 84-day experiment. At 4°C (winter) 99.9% of the population died in the first six weeks on low-nutrient supplies, and most of the remainder also persisted throughout the 84-day experiment. The summer populations were ~100 times larger than those in winter.

Bacillus subtilis is a common soil and gut bacterium that belongs to a special group noted for their ability to escape starvation by forming a dormant and highly resistant *endospore*. Endospore formation is usually triggered by a lack of nutrients and it reverts back to its normal reproductive habit when conditions improve.³⁶ A comprehensive molecular analysis of protein usage in *B. subtilis* during glucose starvation showed a general shift away from protein synthesis and towards carbon metabolism. In contrast, during heat stress most resources were used to increase the amount of chaperones and proteases.³⁷ So, during starvation, energy production had top priority, and, during heat stress protein conformation had top priority. Both responses are rational strategies for keeping the machinery of life working properly under stressed conditions.

Bacterial colonies that develop in complex natural environments are notoriously variable in both phenotypic and genomic diversity compared with those in sterile culture media. Sputum samples of 44 morphologically identical *Pseudomonas aeruginosa* isolates taken from a single patient with cystic fibrosis illustrate this complexity.³⁸ Phenotypic analyses revealed large variances and trade-offs in growth, virulence factors, and quorum sensing signals. Whole genome analysis of 22 isolates revealed high levels of intra-isolate diversity ranging from 5–64 single nucleotide polymorphisms. Recombination, however, and not spontaneous mutation was the dominant driver of this diversity. Phenotypic differences between isolates were likewise not linked to mutations but were correlated with

recombination events. Antibiotic resistance was greater in mixed populations,³⁸ quite possibly because of greater opportunities for horizontal gene transfer (natural genetic engineering).³⁹

When taken together with the very large population numbers in typical bacterial habitats (billions, compared to the 44 isolates reported in the study quoted here) we can see the enormous power that microbes have in generating diversity that can contribute towards survival. The *E. coli* experiments cited earlier³² showed a rapid death rate among most bacteria, but then a surprisingly long persistence time for the survivors. Both experiments began with 500 million cells/ml of substrate and under winter and summer conditions the populations stabilized at about 100,000 and 13 million cells/ml respectively. This dual strategy of lowered metabolic rate and differential individual survival helps to explain why bacteria inhabit all known ecological niches on Earth.

Conclusions

How important is autopoiesis for a general theory of living systems? How important is the fact that it is reversible? The answer to both questions is that they are essential parts of any such theory because they must be present from the beginning. If they are not present from the beginning then the very first cell would rapidly malfunction due to waste accumulation. But once the machinery for synthesis, maintenance, and repair of life’s mechanisms is in place then the life system *automatically* becomes robust under conditions of resource limitation. Having been *made* out of food and water to begin with, the cell can (to a limited and controlled extent) *unmake* itself to produce food and water again when needed. Living organisms, from the smallest prokaryotes to the largest mammals, all have the same strategy for coping with resource limitation—they redirect their metabolism to focus upon energy production so that the protein ‘wheels of life’ keep turning. Bacteria have a three-pronged strategy—they reduce their metabolic rate and their population numbers, and they conserve their mechanisms for sensing when conditions improve so they can rapidly rebuild their population numbers. Humans likewise have built-in mechanisms for re-orienting their metabolism from normal activities to intense focus upon energy production, they reduce their metabolic rate, mobilize stored energy reserves, conserve essential vitamins and minerals, and reduce cell numbers in all soft tissues. Reversible autopoiesis is a foundational design principle that *must* be present at the beginning in any theory of life’s origin. No simple-to-complex Darwinian scenario can meet such a standard and, once again, Genesis-style fiat creation is the only rational explanation.

References

- Mullen, L., Defining Life, *Astrobiology Magazine*, 19 June 2002, astrobio.net/news-exclusive/defining-life/.
- Cleland, C.E., Conceptual challenges for contemporary theories of the origin(s) of life, *Current Organic Chemistry* 17(16):1704–1709, 2013.
- Sarfati, J., *By Design: Evidence for Nature's Intelligent Designer—the God of the Bible*, Creation Book Publishers, 2008.
- Burgess, S., *Hallmarks of Design: Evidence of purposeful design and beauty in nature*, Day One Publications, 2nd edn, 2004.
- Maturana, H.R. and Varela, F.J., *Autopoiesis and cognition: The realization of the living*, Springer Science & Business Media, p.78, 1980.
- Thompson, E., Autopoiesis: The organization of the living, *Mind in Life: Biology, Phenomenology, and the Sciences of Mind*, Harvard University Press, ch. 5, p. 92, 2007.
- scientificamerican.com/article/how-long-can-the-average/?print=true, accessed 4 October 2015.
- Cork, S.J. *et al.*, Improving habitat models and their utility in Koala conservation, *Conservation Biology* 14(3):660–668, 2000.
- Briscoe, N.J. *et al.*, Tree-hugging koalas demonstrate a novel thermoregulatory mechanism for arboreal mammals, *Biological Letters* 10:20140235, dx.doi.org/10.1098/rsbl.2014.0235.
- koalatracker.com.au/koalatracker-blog/koalas-are-water-guzzlers#VmZVn_194dU, accessed 8 December 2015.
- Bender, D.A., Metabolic water, *A Dictionary of Food and Nutrition*, 2005, encyclopedia.com, accessed 5 October 2015.
- en.wikipedia.org/wiki/Olm, accessed 15 October 2015. See also: Hervant, F. *et al.*, Behavioural, physiological and metabolic responses to long-term starvation and refeeding in a blind cave-dwelling (*Proteus anguinus*) and a surface-dwelling (*Euproctus asper*) salamander, *J. Experimental Biology* 204: 269–281, 2001.
- The Trial of Bhagat Singh, in: Historical Trials, *Indian Law Journal*, 2007, web.archive.org/web/20151001142717/http://indialawjournal.com/volume1/issue_3/bhagat_singh.html.
- tpnteam.com/secure/starvation_metabolism.html, accessed 30 September 2015.
- Consolazio, C.F. *et al.*, Metabolic aspects of acute starvation in normal humans (10 days), *The American J. Clinical Nutrition* 20(7):672–683, 1967.
- hellfire-pass.commemoration.gov.au/surviving-the-camps/illness-and-death.php, accessed 8 December 2015.
- nlm.nih.gov/medlineplus/ency/article/001604.htm, accessed 8 December 2015.
- hellfire-pass.commemoration.gov.au/surviving-the-camps/illness-and-death.php, accessed 1 October 2015.
- hellfire-pass.commemoration.gov.au/surviving-the-camps/, accessed 1 October 2015.
- Berg, J.M. *et al.*, Metabolic Adaptations in Prolonged Starvation Minimize Protein Degradation; in: *Biochemistry*, 5th edn, ch. 30.3.1, W.H. Freeman, New York, 2002.
- Kueper, J., Evidence for the adverse effect of starvation on bone quality: a review of the Literature, *International J. Endocrinology*, vol. 2015, Article ID 628740, dx.doi.org/10.1155/2015/628740.
- themedicalbiochemistrypage.org/amino-acid-metabolism.html#alaninecycle, accessed 2 October 2015.
- Mikkelsen, K.H. *et al.*, Systemic, cerebral and skeletal muscle ketone body and energy metabolism during acute hyper-d-β-hydroxybutyrateemia in post-absorptive healthy males, *J. Clinical Endocrinology & Metabolism*, published online, 21 November 2014, dx.doi.org/10.1210/jc.2014-2608.
- Owen, O.E. *et al.*, Brain metabolism during fasting, *J. Clinical Investigation* 46(10): 1589–1595, 1967, doi:10.1172/JCI105650.
- Gilbert, M., *The Holocaust: A History of the Jews of Europe During the Second World War*, Holt, Rinehart, and Winston, New York, 1985, pp.794–795. Quoted in: Williams, S.S., *The Impact of the Holocaust on Survivors and their Children*, sandrawilliams.org/HOLOCAUST/holocaust.html#3, accessed 2 October 2015.
- Longhurst, R., *Famines, food, and nutrition: issues and opportunities for policy and research*, University of Sussex, Brighton; archive.unu.edu/unupress/food/8F091e/8F091E05.htm, accessed 2 October 2015.
- en.wikipedia.org/wiki/Ultramarathon, accessed 6 October 2015.
- Moore, D.R., Nutrition to support recovery from endurance exercise: optimal carbohydrate and protein replacement, *Current Sports Medicine Reports* 14(4): 294–300, 2015.
- Bliss, L.S., Fluid & Electrolytes 101: Recommendations from the Trail and Medical Tent, *UltraRunning Magazine*, 24 November 2013.
- Deldicque, L. and Francaux, M., Recommendations for healthy nutrition in female endurance runners: an update, *Frontiers in Nutrition* 2, article 17, 2015.
- Woolley, M., The importance of fat metabolism in ultra running, *Ultra Running Community Newsletter*, ultrarunningcommunity.com/14-article/779-the-importance-of-fat-metabolism-in-ultra-running.
- Verhoeven, J.T.A. and Sorrell, B.K., Plant adaptations and microbial processes in wetlands, *Annals of Botany* 105(1):127–128, 2010 | doi:10.1093/aob/mcp266.
- Thompson, L.R. *et al.*, Patterns of ecological specialization among microbial populations in the Red Sea and diverse oligotrophic marine environments, *Ecology and Evolution* 3(6):1780–1797, 2013.
- en.wikipedia.org/wiki/Stringent_response, accessed 15 October 2015. See also: Carneiro, S. *et al.*, Stringent response of *Escherichia coli*: revisiting the bibliome using literature mining, *Microbial Informatics and Experimentation* 1:14, 2011.
- Xavier, R.N. *et al.*, Effect of long-term starvation on the survival, recovery, and carbon utilization profiles of a bovine *Escherichia coli* o157:h7 isolate from New Zealand, *Applied and Environmental Microbiology* 80(14):4383–4390, 2014.
- Bacterial Endospores*, Cornell University Department of Microbiology, micro.cornell.edu/research/epulopiscium/bacterial-endospores. 10 December 2015.
- Maaß, S. *et al.*, Highly precise quantification of protein molecules per cell during stress and starvation responses in *Bacillus subtilis*, *Molecular & Cellular Proteomics* 13:2260–2276, 2014 | doi:10.1074/mcp.M113.035741.
- Darch, S.E. *et al.*, Recombination is a key driver of genomic and phenotypic diversity in a *Pseudomonas aeruginosa* population during cystic fibrosis infection, *Nature Scientific Reports* 5:7649 | doi:10.1038/srep07649, 2015.
- Shapiro, J.A., *Evolution: A View from the 21st Century*, FT Press Science, 2011.

Alex Williams B.Sc., M.Sc.(Hons), M.Ai.Biol., Dip.C.S., Th.L. has been a professional botanist, analytical chemist, environmental consultant, statistician, missionary, science writer, and illustrator, and has published numerous peer-reviewed articles on a wide range of subjects. He was an Australian representative and then consultant to the International Atomic Energy Agency, chairman of an international group of scientists, and delivered the invited review in his field at an international symposium. He is currently research associate at the Western Australian Herbarium in grass taxonomy, and has contributed many items to *Creation* and *Journal of Creation* and co-authored *Dismantling the Big Bang*.

Evidence strongly suggests the Laurentide Ice Sheet was thin

Michael J. Oard

The Ice Age has many unknowns for uniformitarian science. One of those is the thickness of former ice sheets. Several methods are used to estimate their thickness, one of which is to simply claim by analogy that the thickness of former ice sheets was similar to the Antarctic Ice Sheet. A second method is to estimate sea level fall during the Ice Age and translate that into ice sheet volume. However, estimates of sea level fall assume a large ice volume, which is circular reasoning. Instead of uncertain analogies and indirect estimation, a more empirical thickness can be deduced from the multidomed nature of the Laurentide Ice Sheet, its unglaciated margins, and observations of glacial rebound. Such an analysis reveals that the Laurentide Ice Sheet, as well as the Cordilleran and Scandinavian Ice Sheets, were much thinner than previously believed. This also means that the maximum sea level reduction during the Ice Age was correspondingly less.

Uniformitarian scientists have difficulty explaining the Pleistocene Ice Age.¹ One major problem is determining how an ice age could begin. They know that the geological evidence requires some sort of ice age explanation. Secular scientists have devised dozens of hypotheses to explain how ice ages could have occurred, the most popular of which is currently the Milankovitch (or astronomical) theory. The Milankovitch theory posits that ice ages are ‘paced’ by slow, gradual changes in Earth’s orbital motions over many hundreds of thousands of years. These changes modulate the amount of summer sunlight in the northern high latitudes, ultimately causing the ice sheets to retreat or advance. But even this popular theory has numerous problems, the most obvious of which is the difficulty of ice ages being caused by such small changes in the distribution of solar insolation when integrated for warm and cold half years and whole hemispheres.² Of course, they do not consider that the problem is the uniformitarian assumption itself.

It is universally agreed the ice sheets built up with time, reached a maximum thickness, and later melted during deglaciation. Unfortunately, many details about these former ice sheets have been lost, such as their precise areas and thicknesses.

According to the uniformitarian model, ice ages properly began with the development of the Antarctic Ice Sheet about 34 Ma ago, if not before, reaching its present thickness about 15 Ma ago.³ Uniformitarians also believe the Greenland Ice Sheet started developing around 38 Ma ago and reached steady state about 2.7 Ma ago.⁴ Then about 2.6 Ma ago, the start of the Quaternary period, they believe that the ice sheets that no longer exist started a glacial/interglacial cycle that repeated every 40,000 years until about a million years ago, at which time the period mysteriously changed to 100,000 years.^{5–7} Uniformitarians now believe that the total number of ice ages of various intensities in the Quaternary was over 50.⁸

Since each ice age is thought to erase practically all geological evidence for former ice ages, uniformitarian scientists have determined the number of ice ages from chemical ‘wiggles’ in the deep sea cores, interpreting those ‘wiggles’ under the assumption that the Milankovitch theory of Pleistocene ice ages is true. These ‘wiggles’ are then used to calibrate age-depth models, which assign ages to the deep ice cores, particularly those of central Antarctica. However, they then claim that deep sea cores, as well as ice cores, support the astronomical theory of ice ages—a process steeped in circular reasoning.⁹

In the creation model, there were no ice sheets immediately after the Flood, so the Greenland and Antarctic Ice Sheets developed during the single post-Flood Ice Age, rapidly at first and afterwards continuing to build slowly until reaching a steady state.¹⁰ Immediately after the Flood, sea level was about 68 m higher than today because there were no ice sheets.¹¹ Absence of the Antarctic would add an equivalent of 61 m of sea level rise,¹² while Greenland would add 7 m.¹³ At the peak of the Ice Age, sea level is estimated to have fallen about 55 m below that of today, assuming the ice sheets were about half the size of uniformitarian estimates.¹⁴

How thick were the former ice sheets?

The greatest difficulty for both models is estimating the thicknesses of the former ice sheets, since they no longer exist. Uniformitarian scientists commonly rely on theoretical concepts within their model:

“Because the ice sheets left little direct evidence of their height, estimates of LGM [Last Glacial Maximum] ice volume have come largely from indirect evidence or from glaciological modelling.”¹⁵

Thicknesses based on current ice sheets

The Laurentide Ice Sheet existed over central and eastern Canada and the adjacent northern United States during the Ice Age and was the largest former ice sheet (figure 1). Estimating its volume can provide an approximate total ice volume for the Ice Age by assuming the Scandinavian and Cordilleran Ice Sheets were the same thickness. The Scandinavian Ice Sheet developed over northern Europe and northwest Asia, while the Cordilleran Ice Sheet covered the mountainous areas of British Columbia, Canada, and the adjacent northern United States.

The main assumption uniformitarian scientists have used to explain ice sheet thicknesses is time. Since they allow for hundreds of thousands to millions of years for ice sheets to develop, they commonly assume that the former ice sheets built up to the thicknesses of the present ice on Antarctica or Greenland. With reference to the Laurentide Ice Sheet during the Ice Age, Bloom states:

“Unfortunately, few facts about its thickness are known. . . . In the absence of direct measurements about the thickness of the Laurentide ice sheet, we must turn to analogy and theory.”¹⁶

Andrews added:

“There have been several reconstructions of various Pleistocene ice sheets based essentially on glaciological theory. These have relied implicitly or explicitly on the analog premise that the appearance of the former ice sheets was not unlike that of the Greenland or Antarctic ice sheets today. This premise may not be valid.”¹⁷

And Bonelli *et al.* admit to major uncertainties: “However, uncertainties still remain about the shape, volume and thickness of these former ice sheets.”¹⁸

Despite its lack of empirical validity, Christoffersen *et al.* recently reinforced the belief that, like Antarctica, the Laurentide Ice Sheet was up to 4 km thick: “Comparable hydrologic systems may have existed beneath the Laurentide Ice Sheet, which was similar in size to the modern Antarctic Ice Sheet.”¹⁹ This ice thickness is assumed in numerous computer climate simulations, including in the Ice-4G model.²⁰ The Ice-4G model is the fourth in a series of ice-thickness models that are used as input to numerical simulations.

There is another reason why uniformitarian scientists believe the Laurentide Ice Sheet built up to 4 km thick. They believe the ice sheet started in northern Canada (Hudson Bay area) and slowly crept into the northern United States over tens of thousands of years. So for the Laurentide Ice Sheet to move from near sea level in central Canada to northern Montana, it would have to push uphill about 1,000 metres. How could this happen? On level ground, the driving force for ice movement is the surface slope of the ice itself, *not* the (small) slope of the ground:

“The driving stress, and hence the shear stress at the bed, are determined by the surface slope. Ice therefore tends to flow in the direction of maximum surface slope even if the bed slopes in the opposite direction.”²¹

So the Laurentide Ice Sheet could indeed flow uphill if the central part of the ice sheet were thick enough to ensure that the surface slope of the ice still dipped downward to the south. A 4 km thick ice sheet is thought to be able to accomplish this, if indeed this is what happened.

Thicknesses based on sea level fall

A second method commonly used to estimate the thicknesses and volumes of the former ice sheets is to determine the amount of sea level fall believed to have occurred at the last glacial maximum.²² However, past sea levels are unknown since there are several variables which determine sea level at any one place. Tarasov and Peltier admit:

“Past reconstructions of the deglaciation history of the North American (NA) ice-sheet complex have relied either on largely unconstrained and limited explorations of the phase space of solutions produced by glaciological models or upon geophysical inversions of relative sea-level (RSL) data which suffer from incomplete geographic coverage of the glaciated regions, load history amplitude/timing ambiguities, and lack of a priori glaciological self-consistence [emphasis added].”²³

A 2002 article in *Quaternary Science Reviews* was titled: “Estimating past continental ice volume from sea-level data”,²⁴ showing that one method of estimating ice sheet height is by taking the lowest postulated ice age sea level and projecting the missing ocean water onto the land as ice.

How is the lowest sea level determined? It is common practice for uniformitarian scientists to estimate past sea levels *based* on presumed ice sheet thickness and volume. So they calculate sea level had fallen to around 110–120 m below that of today for an Antarctic-like ice sheet over North America and Eurasia. Flint candidly admitted:

“A greater potential error [in estimating sea level] lies in the estimation of average thickness and volumes of glaciers, particularly ice sheets that no longer exist. Thus far the profiles of such glaciers have been *reconstructed by analogy with those of existing ice sheets*, which for one reason or another may not be truly analogous [emphasis added].”²⁵

Since they ‘know’ how far the sea level fell during the last glacial maximum, they search for sea level indicators at about 110–120 m depth. They assume the edges of stable continental shelves did not uplift or sink during the Ice Age or afterwards. Since sea bottom features can be formed

in various ways, unrelated features could be claimed as evidence of the expected former sea level. This is another example of the reinforcement syndrome that is so pervasive in uniformitarian earth science.^{26,27}

Ice sheets not that thick?

Laurentide Ice Sheet multi-domed

Whereas earlier models assumed that there was one single-domed, thick Laurentide Ice Sheet centred over Hudson Bay, other evidence indicates the ice sheet was multi-domed and thinner. There are many pieces of evidence, which include: the direction of striated bedrock; the long axes of drumlins, grooves, and roches moutonnées; and the provenance of erratic boulders.^{28,29} Drumlins are streamline-shaped hills of glacial till elongated in the direction of ice movement. Long glacial grooves form by rocks embedded in the bottom of a glacier carving into bedrock that can stretch for kilometres. Roches moutonnées are small streamlined bedrock hills, and erratic boulders are large till material that do not have a local source but have been transported from another area. This evidence demonstrates there were at least two major domes on the Laurentide Ice Sheet, one west and northwest

of Hudson Bay in Keewatin and the other east of Hudson Bay over Labrador, because the orientated features point away and erratics spread from these centres. Other possible ice domes are over Baffin Bay/Foxe Basin, the Queen Elizabeth Islands, and between Hudson Bay and the Great Lakes (figure 1).

Some glaciologists have attempted to dismiss the multiple domes as a result of late glacial thinning from a single dome that melted down and broke up into multiple domes.³⁰ However, the presence of erratic boulders and cross-cutting glacial lineations provides evidence against the break-up of a single dome. Distinctive glacial erratics on and below the surface show the Keewatin ice dome during the Ice Age was always in the same location and that ice *never* flowed westward over the area from a large ice dome in Hudson Bay.³¹ In addition, evidence indicates that the ice-flow direction on the east side of Hudson Bay was always toward the west, presumably from a separate ice dome on Labrador.^{32,33} This is because the ice flow indicators and erratics diverge from both Keewatin and Labrador ice domes. As such, the multidome Laurentide Ice Sheet is now mostly accepted by mainstream scientists.^{34,35} Klemens *et al.* state: “Our results reveal that ice-dispersal centres in Keewatin and Quebec [the Labrador ice dome] were dynamically independent for most of pre-LGM time.”³⁶ A new gravity survey also shows that there were two main ice domes.^{37,38}

A multidomed ice sheet implies that the Laurentide Ice Sheet was substantially thinner than today’s ice sheets over Antarctica or Greenland.³⁹ Occhietti concluded: “These results change the concept of the Laurentide ice sheet radically. They imply, notably, a much smaller ice volume, and complex margins.”⁴⁰

The Cordilleran Ice Sheet was also likely thin. Ice flow lines in the interior of British Columbia were strongly influenced by the underlying topography, indicating a fairly thin ice sheet that did not overflow the mountainous valleys.³⁵ Thinner ice sheets are influenced by topographical variations, while thick ice sheets, like observed on Antarctica, often flow across topography.

Ice thin along the margin

Not only does the interior of the Laurentide Ice Sheet indicate a thinner ice sheet, but also the marginal area. Here, ice thicknesses can be deduced by the height of nunataks, which are



Figure 1. The Cordilleran Ice Sheet, western Canada, and the Laurentide Ice Sheet, central and eastern Canada, showing two major domes west and east of Hudson Bay and three other postulated ice domes over the Laurentide Ice Sheet. (Drawn by Mrs Melanie Richard.)



Figure 2. Haystack Butte (left) and Middle Butte (right) in the Sweet Grass Hills, north-central Montana, USA, the tops of which stuck up above the ice as nunataks (view west)

mountains or hills that protruded unscathed above the ice, and the height of lateral features, like lateral moraines, left from ice lobes. Ice lobes very likely are the results of glacial surges, which are sudden increases in glacial velocity of about 10 to 100 times that are likely caused by water lubricating the base of the glacier/ice sheet (see below).

Evidence suggests that the southwest edge of the Laurentide Ice Sheet was very thin. This is based on the Cypress Hills and Sweet Grass Hills of north-central Montana (figure 2). The tops of these two hills stuck above the ice, determining the height of the ice sheet at 200 to 300 m thick in this area.⁴¹ Thus, the top of the ice sheet had little southerly slope between the Cypress Hills of southern Canada and the Sweet Grass Hills of north-central Montana.^{42,43} Of course, along the edge, the surface slopes to the south, but the slope from the edge to the Cypress

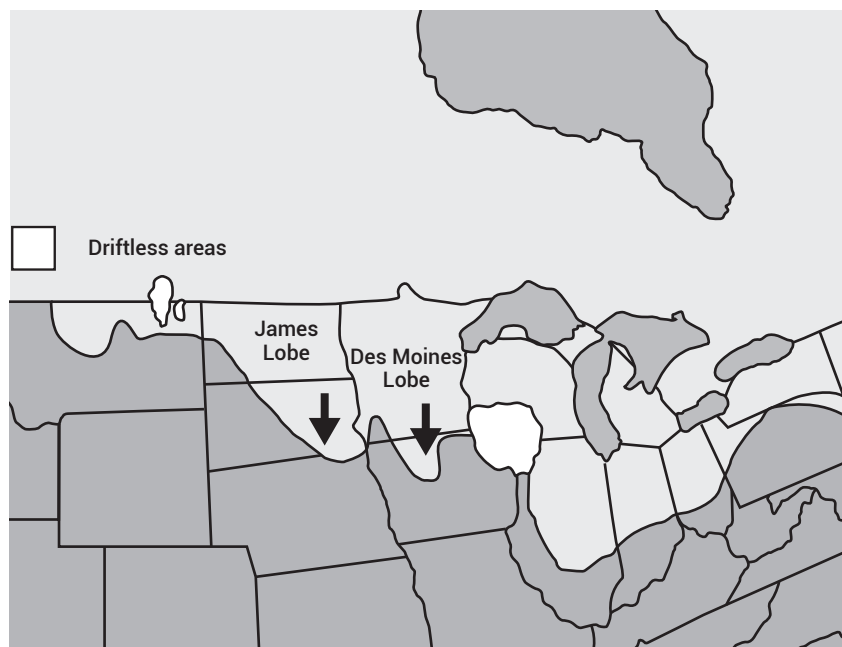


Figure 3. The boundary of the 'last' ice age in the US Midwest, which I believe is the real boundary of the Ice Age. Two driftless areas occur in southwest Wisconsin and northeast Montana and south-central Saskatchewan. Note the James and Des Moines lobes, which probably represent surges. (Drawn by Mrs Melanie Richard.)



Figure 4. Erosional remnants of St Peter Sandstone in the driftless area of southwest Wisconsin

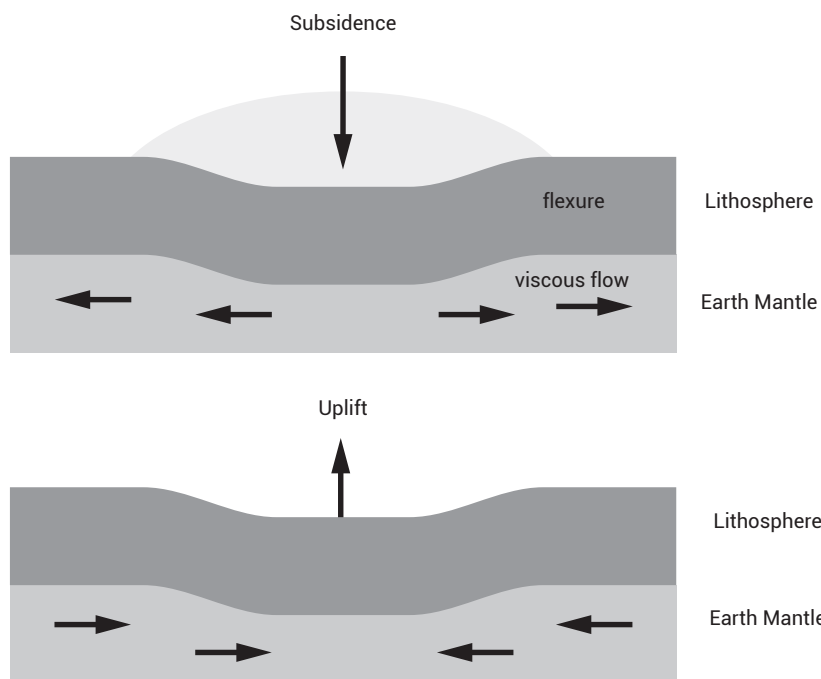


Figure 5. Glacial isostasy. In the top diagram, the ice pushes the lithosphere down but after the ice melts, the lithosphere slowly rebounds upward. (Drawn by Mrs Melanie Richard.)

Hills is about 20% of that along the edge of the Antarctic Ice Sheet.⁴³ This edge of the ice was either the result of a surge from central Canada southward to northern Montana or else the ice sheet in the area more or less grew in place, or both. Creationists do not have to model a 4-km-thick ice sheet in central Canada to explain the ice sheet in northern Montana since in their model the ice sheets more or less grew in place with instant winter right after the Flood.¹

In the north-central United States, two lobes are claimed to have developed during the ‘last’ glaciation (the Wisconsin), which travelled as far as southeast South Dakota (the James Bay lobe) and north-central Iowa (the Des Moines lobe) (figure 3). There do not appear to be any signs of glaciation, such as lateral and end moraines, south of these lobes, except erratic boulders and a covering of glacial debris (personal observations), which could have been deposited by glaciofluvial and glaciolacustrine processes during deglaciation.⁴⁴ The James Bay and Des Moines lobes were most likely thin, filling up the low-lying areas of the terrain.⁴⁵ Horseshoe-bounding moraines are claimed around the Des Moines lobe that would indicate the lobe was thin and gently sloping.^{43,45} This method is based on assuming that the highest moraine elevation in any lateral moraine corresponds to the ice surface elevation at that point and by connecting points on the corresponding lateral moraine. By lining up the elevations within the horseshoe-shaped moraines, it has been deduced that the edge of the lobes was thin. This method has its drawbacks, but most glacial geologists accept that these lobes were thin.⁴⁶ The problem with such a thin margin is that the driving stress of the Des Moines lobe, its southerly surface slope, is way too small for it to have slowly spread from the north,⁴⁷ unless it surged southward from the north,



Figure 6. Sea level fall in the northern Gulf of Bothnia along the northeast Swedish coast, showing the location of sea level in 1846 and the amount of fall since then

possibly aided by a lake ponded to the south, which would have lubricated the base during the surge. Surges and ice streams are believed to have existed at the edge of much of the Laurentide and Cordilleran Ice Sheets.³⁵

In the creationist Ice Age model, surges would be much faster and more frequent since it is likely that most, if not all, the ingredients necessary for fast ice movement existed.^{48,49} These ingredients are soft deformable basal sediments, ‘warm’ ice, impurities, a steep southerly slope that would thin after the surge, and large amounts of basal water. Although the slope on the Des Moines lobe was relatively low, it is possible that the slope was steep in Minnesota or southern Canada before surging, and flattened out during surging.

Moreover, driftless areas that were *never* glaciated in southern Saskatchewan and adjacent northeast Montana,⁵⁰ and southwest Wisconsin and vicinity⁵¹ (figure 3), show the ice was quite thin in the surrounding areas. Besides a lack of glacial debris, the surface has vertical erosional remnants of St Peter Sandstone (figure 4) that would have been planed off by at least the last few ‘ice ages’. The marginal lobes and the two driftless areas imply that the ice thickness was about one fifth that expected along the margin of an Antarctic-type ice sheet. Ice flow direction indicators show that ice sheet movement at the edge was strongly influenced by the low

topographic features below the ice, reinforcing the idea that the ice sheet margin was thin.⁵²

The northwest margin of the Laurentide Ice Sheet was also apparently thin.⁵³ It was only the southeast margin that was relatively thick, although the exact thickness is unknown. Some think that the ice was only 800 m deep above msl in the mountainous areas of New England.⁵⁴ Of course, thicker ice is expected in New England and southeast Canada since this area was close to the water vapour source of the Atlantic Ocean and major storm tracks.¹ Regardless, the southeast margin of the Laurentide Ice Sheet was probably thinner than expected compared to an ice sheet like Antarctica.

The thickness of the northeast margin of the Laurentide Ice Sheet has been much debated, but a recent report claims that it was as thick as 1,600 m, which is 1,000–1,500 m thinner than used in glacial isostatic rebound models.⁵⁵

Although information is limited, the edge of the Scandinavian Ice Sheet was also lobed and likely thinner than expected. Along the edge of the Baltic Sea Kalm found:

“Thus, in the peripheral zone close to the LGM [Last Glacial Maximum], but also at Baltija (Vepsian) and South- and Middle Lithuanian margins the ice was divided into numerous small ice lobes with variable movement directions indicating a [sic] relatively thin

glacier that was conformed to the local topography.”⁵⁶

A later research report claimed that the southeast sector was thin to non-existent for at least part of the ‘last’ ice age.⁵⁷ Such a thin, lobed ice sheet edge could not occur if the Scandinavian Ice Sheet was as thick as Antarctica.

So, most of the marginal areas that can be estimated with any degree of accuracy show significantly thinner ice than expected by uniformitarians. When added to the evidence of more than one dome, the Laurentide Ice Sheet was apparently substantially thinner than many uniformitarian estimates.

Glacial isostasy indicates a thinner ice sheet

Glacial isostasy is the depression or rebounding of the earth’s crust and upper mantle caused by the addition or subtraction, respectively, of an ice sheet (figure 5). The amount of crustal rebound after the ice melted, plus the estimated amount of rebound left to go, can provide a crude estimation of ice sheet volume. Both the Scandinavia and Hudson Bay regions have been rising since the end of the Ice Age. It is estimated that Hudson Bay has rebounded 315 m while Scandinavia has risen 290 m.^{58,59} It has been roughly estimated that this former depression represents three times the height of the former ice sheets, which, by using the mean between the rebounds of Hudson Bay and Scandinavia, indicates an ice thickness of around 910 m. However, some estimate that half the rebound is caused by former ice sheets,⁶⁰ which would make the thickness of the ice only about 455 m. There are many complicating variables in such estimates, such as the viscosity of the mantle and the elastic thickness of the lithosphere.

Although some scientists believe isostatic uplift from melted ice sheets is about finished,⁶⁰ others believe these areas have not yet recovered. The Gulf of Bothnia in the Baltic Sea is currently rising about one cm per year (figure 6). So, it is difficult to obtain an accurate estimate of the remaining amount of rebound from melted ice sheets. Some scientists estimate that Hudson Bay and the northern Gulf of Bothnia will rise another 100 to 200 m.

If we were to take the most pessimistic numbers for glacial rebound in the past and expected in the future, then we would expect about 500 m of total rebound, which translates into about 1,500 m of ice in these areas. Although this estimate is uncertain and likely too high, based on several assumptions, it is still only about one third the generally accepted thickness of the Laurentide Ice Sheet in the single dome model.

Estimates based on oxygen isotopes

Another rather indirect method of estimating ice volume is to use the oxygen isotope ratios of carbonate minerals from the shells of foraminifera in deep sea cores. However, the equation that relates these measurements to ice volume has two unknowns, the temperature at which the carbonate was

added to the shell and the original oxygen isotope ratio of the sea water. The latter variable is assumed to be related to ice volume. However, there are numerous other variables and complications in using this method.^{61,62} Clark *et al.* remind us: “However, other factors (temperature, local salinity) that affect the isotopic signal measured in carbonate fossils partially obscure the ice volume component.”⁶³

Summary

Although many uniformitarian scientists persist in assuming that the Laurentide Ice Sheet was as thick as Antarctica, more direct field evidence from the interior and margins strongly suggest that the Laurentide Ice Sheet was significantly thinner. Since this ice sheet was by far the largest of all extinct ice sheets in Earth history, it is reasonable to conclude that the other ice sheets were thinner also. Evidence that the Cordilleran and Scandinavian Ice Sheets were also thinner was presented above. A total ice volume during the Ice Age significantly less than most uniformitarian estimates implies that sea level was not nearly as low as thought during glacial maximum, which is consistent with the creationist Ice Age model.¹⁴

References

- Oard, M.J., *Frozen in Time: Woolly Mammoths, the Ice Age, and the Biblical Key to Their Secrets*, Master Books, Green Forest, AR, 2004.
- Vernekar, A.D., Long-period global variations of incoming solar radiation, *Meteorological Monographs* 12(34), American Meteorological Society, Boston, MA, 1972.
- Rose, K.C., Ferraccioli, F., Jamieson, S.S.R., Bell, R.E., Corr, H., Creyts, T.T., Braaten, D., Jordan, T.A., Fretwell, P.T. and Damaske, D., Early East Antarctic Ice Sheet growth recorded in the landscape of the Gamburtsev subglacial mountains, *Earth and Planetary Science Letters* 375:1–12, 2013.
- Bierman, P.R., Corbett, L.B., Graly, J.A., Neumann, T.A., Lini, A., Crosby, B.T. and Rood, D.H., Preservation of a preglacial landscape under the center of the Greenland Ice Sheet, *Science* 344:402–405, 2014.
- Tabor, C.R., Poulsen, C.J. and Pollard, D., Mending Milankovitch’s theory: obliquity amplification by surface feedbacks, *Climates of the Past* 10:41–50, 2014.
- Oard, M.J., The astronomical theory of the Ice Age becomes more complicated, *J. Creation* 19(2):16–18, 2005.
- Oard, M.J., Astronomical troubles for the astronomical hypothesis of ice ages, *J. Creation* 21(3):19–23, 2007.
- Walker, M. and Lowe, J., Quaternary science 2007: a 50-year retrospective, *J. Geological Society London* 164:1073–1092, 2007.
- Hebert, J., Circular reasoning in the dating of deep seafloor sediments and ice cores: the orbital tuning method, *Answers Research J.* 7:297–309, 2014.
- Oard, M.J., *The Frozen Record: Examining the Ice Core History of the Greenland and Antarctic Ice Sheets*, Institute for Creation Research, Dallas, TX, 2005.
- Oard, M.J., (ebook) *Earth’s Surface Shaped by Genesis Flood Runoff*, michael.oards.net?GenesisFloodRunoff.htm, 2013.
- Huybrechts, P., Steinhage, D., Wilhelms, F. and Bamber, J., Balance velocity and measured properties of Antarctic ice sheet form a new compilation of gridded data for modelling, *Annals of Glaciology* 30:52–60, 2000.
- Cuffey, K.M. and Marshall, S.J., Substantial contribution to sea-level rise during the last interglacial from the Greenland Ice Sheet, *Nature* 404:591–594, 2000.
- Oard, M.J., *An Ice Age Caused by the Genesis Flood*, Institute for Creation Research, Dallas, TX, 1990.
- Clark, P.U. and Mix, A.C., Ice sheets by volume, *Nature* 406:689, 2000.

16. Bloom, A.L., Glacial-eustatic and isostatic controls of sea level; in: Turekian, K.K. (Ed.), *The Late Cenozoic Glacial Ages*, Yale University Press, New Haven, CT, p. 367, 1971.
17. Andrews, J.T., On the reconstruction of Pleistocene ice sheets: a review, *Quaternary Science Reviews* 1:12, 1982.
18. Bonelli, S., Charbit, S., Kageyama, M., Willez, M.-N., Ramstein, G., Dumas, C. and Quiquet, A., Investigating the evolution of major Northern Hemisphere ice sheets during the last glacial-interglacial cycle, *Climate of the Past* 5:329–345, 2009.
19. Christoffersen, P., Tulaczyk, S., Wattus, N.J., Peterson, J., Quintana-Krupinski, N., Clark, C.D. and Sjunneskog, C., Large subglacial lakes beneath the Laurentide Ice Sheet inferred from sedimentary sequences, *Geology* 36(7):563, 2008.
20. Peltier, W.R., Postglacial variations in the level of the sea: implications for climatic dynamics and solid-Earth geophysics, *Reviews of Geophysics* 36:603–689, 1998.
21. Cuffey, K.M. and Patterson, W.S.B., *The Physics of Glaciers*, 4th edn, Butterworth-Heinemann, Amsterdam, p. 296, 2010.
22. Tarasov, L. and Peltier, W.R., A geophysically constrained large ensemble analysis of the deglacial history of the North American ice-sheet complex, *Quaternary Science Reviews* 23:359–388, 2004.
23. Tarasov and Peltier, ref. 22, p. 359.
24. Milne, G.A., Mitrovica, J.X. and Schrag, D.P., Estimating past continental ice volume from sea-level data, *Quaternary Science Reviews* 21:361–376, 2002.
25. Flint, R.F., *Glacial and Quaternary Geology*, John Wiley and Sons, New York, pp. 317–318, 1971.
26. Oard, M.J., *Ancient Ice Ages or Gigantic Submarine Landslides?* Creation Research Society Books, Chino Valley, AZ, 1997.
27. Oard, M.J., The reinforcement syndrome ubiquitous in the earth sciences, *J. Creation* 27(3):13–16, 2013.
28. Andrews, ref. 17, pp. 1–30.
29. Greenwood, S.L. and Kleman, J., Glacial landforms of extreme size in the Keewatin sector of the Laurentide Ice Sheet, *Quaternary Science Reviews* 29: 1894–1910, 2010.
30. Andrews, ref. 17, p. 10.
31. Shilts, W.W., Cunningham, C.J. and Kaszycki, C.A., Keewatin Ice Sheet—re-evaluation of the traditional concept of the Laurentide Ice Sheet, *Geology* 7:537–541, 1979.
32. Hillaire-Marcel, C., Grand, D.R. and Vincent, J.S., Comments and reply on Keewatin Ice Sheet—re-evaluation of the traditional concept of the Laurentide Ice Sheet and glacial erosion and ice sheet divides, northeastern Laurentide Ice Sheet, on the basis of distribution of limestone erratics, *Geology* 8:466–467, 1980.
33. Shilts, W.W., Flow patterns in the central North American ice sheet, *Nature* 286: 213–218, 1980.
34. Bonelli *et al.*, ref. 18, p. 337.
35. Kleman, J., Jansson, K., De Angelis, H., Stroeve, A.P., Hättestrand, C., Alm, G. and Glasser, N., North American Ice Sheet build-up during the last glacial cycle, 115–21 kyr, *Quaternary Science Reviews* 29:2036–2051, 2010.
36. Klemen *et al.*, ref. 35, p. 2036.
37. Otieno, F.O. and Bromwich, D.H., Contribution of atmospheric circulation to inception of the Laurentide Ice Sheet at 116 kyr BP, *J. Climate* 22:39–57, 2009.
38. Tamisiea, M.E., Mitrovica, J.X. and Davis, J.L., GRACE gravity data constrain ancient ice geometries and continental dynamics over Laurentia, *Science* 316: 881–883, 2007.
39. Andrews, ref. 17, p. 1.
40. Occhietti, S., Laurentide Ice Sheet: oceanic and climatic implications, *Palaeogeography, Palaeoclimatology, Palaeoecology* 44:1–22, 1983.
41. Lopez, D.A., Geology of the Sweet Grass Hills, North-Central Montana, *Montana Bureau of Mines and Geology Memoir* 68, Montana Bureau of Mines and Geology, Butte, MT, 1995.
42. Lemke, R.W. *et al.*, Glaciated area east of the Rocky Mountains; in: Wright, Jr, H.E. and Frey, D.C. (Eds.), *The Quaternary of the United States*, Princeton University Press, Princeton, NJ, pp. 15–26, 1965.
43. Mathews, W.H., Surface profiles of the Laurentide Ice Sheet in its marginal areas, *J. Glaciology* 13(67):37–43, 1974.
44. I have concluded that the early glaciologists mistook water-laid glacial debris for grounded ice sheets and so claimed that the Laurentide Ice Sheet extended as far as northeast Kansas and northern Missouri in the Midwest of the United States.
45. Clark, P.U., Surface form of the southern Laurentide Ice Sheet and its implications to ice-sheet dynamics, *GSA Bulletin* 104:595–605, 1992.
46. Hooyer, T.S. and Iverson, N.R., Flow mechanism of the Des Moines lobe of the Laurentide ice sheet, *J. Glaciology* 48(63):575–586, 2002.
47. Oard, M.J., Long-age puzzle of thin ice at the edge of the Laurentide Ice Sheet, *J. Creation* 18(2):5–6, 2004.
48. Horstemeyer, M.F. and Gullet, P., Will mechanics allow a rapid Ice Age following the Flood?; in: Ivey, Jr, R.L. (Ed.), *Proceedings of the Fifth International Conference on Creationism*, Creation Science Fellowship, Pittsburgh, PA, pp. 165–174, 2003.
49. Sherburn, J.A., Horstemeyer, M.F. and Solanki, K., Simulation analysis of glacial surging in the Des Moines ice lobe; in: Snelling, A.A. (Ed.), *Proceedings of the Sixth International Conference on Creationism*, Creation Science Fellowship and Institute for Creation Research, Pittsburgh, PA, and Dallas, TX, pp. 263–273, 2008.
50. Klassen, R.W., Late Wisconsinan and Holocene history of southwestern Saskatchewan, *Canadian J. Earth Sciences* 31:1822–1837, 1994.
51. Riewe, T., The ‘driftless area’: a puzzle to geologists, geographers, and drillers, *Water Well J.*, February 2001.
52. Clayton, L., Teller, J.T. and Attig, J.W., Surging of the southwestern part of the Laurentide Ice Sheet, *Boreas* 14:235–241, 1985.
53. Beget, J., Low profile of the northwest Laurentide Ice Sheet, *Arctic and Alpine Research* 19:81–88, 1987.
54. Caldwell, D.W. and Hanson, L.S., The nunatak stage on Mt. Katahdin, northern Maine, persisted through the Late Wisconsinan, *GSA Abstracts with Programs* 18:8, 1986.
55. Simon, K.M., James, T.S. and Dyke, A.S., A new glacial isostatic adjustment model of the Innuian Ice Sheet, Arctic Canada, *Quaternary Science Reviews* 119: 11–21, 2015.
56. Kalm, V., Ice-flow pattern and extent of the last Scandinavian Ice Sheet southeast of the Baltic Sea, *Quaternary Science Reviews* 44:55, 2012.
57. Räsänen, M.E., Huittinen, J.V., Bhattarai, S. and Harvey III, J., The SE sector of the Middle Weichselian Eurasian Ice Sheet was much smaller than assumed, *Quaternary Science Reviews* 122:131–141, 2015.
58. Eronen, M., Late Weichselian and Holocene shore displacement in Finland; in: Smith, D.E. and Dawson, A.G. (Eds.), *Shorelines and Isostasy*, Academic Press, New York, pp. 183–207, 1983.
59. Fairbridge, R.W., Isostasy and eustasy; in: Smith, D.E. and Dawson, A.G. (Eds.), *Shorelines and Isostasy*, Academic Press, New York, pp. 3–28, 1983.
60. Mitrovica, J.X., Going halves over Hudson Bay, *Nature* 390:444–447, 1997.
61. Oard, M.J., Ice ages: the mystery solved? Part II: the manipulation of deep-sea cores, *Creation Research Society Quarterly* 21(3):125–137, 1984.
62. Oard, M.J. and Reed, J.K., Cyclostratigraphy and Astrochronology Part III: Critique of the Milankovitch Mechanism, *Creation Research Society Quarterly* (in press).
63. Clark, P.U., Mix, A.C., Bard, E., Ice sheets and sea level of the last glacial maximum, *EOS, Transactions, American Geophysical Union* 82(22):241, 246–247, 2001.

Michael J. Oard has an M.S. in atmospheric science from the University of Washington and is now retired after working as a meteorologist with the US National Weather Service in Montana for 30 years. He is the author of *Frozen in Time*, *Ancient Ice Ages or Gigantic Submarine Landslides?*, *Flood by Design*, *Dinosaur Challenges and Mysteries*, and *Exploring Geology with Mr. Hibb*. He serves on the board of the *Creation Research Society*.

Pseudogenes and bacterial genome decay

Jean O'Micks

Contrary to the evolutionary idea of junk DNA, many pseudogenes still have function in the genomes of archaea, bacteria, and also eukaryotes, such as humans. As part of the creation model, the genomes of organisms such as bacteria are undergoing processes of decay whereby their genes lose function and are eventually not expressed, and they may eventually be excised from the genome. This type of loss of gene function is called pseudogenization, which is widespread in bacteria, and is characteristic of both pathogenic and non-pathogenic species of bacteria. Pseudogenization occurs via non-synonymous base pair substitution, base pair insertion, frameshift mutation, gene truncation, loss of promoter, disruption by transposon, or failed horizontal gene transfer. Gene loss is a frequent characteristic of adaptation by pathogenic bacteria to different host species. It is also a differential process according to the kind of host species that is colonized by bacterial species. Reflective of this is the way certain genes undergo different patterns of pseudogenization in different baranomes.

Pseudogenes are considered to be dysfunctional genes that are either diminished in expression, are no longer expressed or no longer code for protein. In other cases, still functional genes may be misannotated pseudogenes. According to some creation models, pseudogenization in bacteria can be diagnostic of genome decay.¹ The ENCODE project has revealed near-total functionality of the genome and shown that about one fifth of all pseudogenes are being transcribed in humans.² Pseudogenes are quite widespread in bacterial genomes,³ and even if the proportion of actively transcribed ones is lower than in human genomes, so their possible functionality still warrants an examination. Like the evolutionary model, the creation model predicts both functional and non-functional parts of the genome. Currently it is unclear whether pseudogenes should be classified as functional or non-functional parts of the genome. In this paper we will explore the recent scientific progress on pseudogenes to gain insight into how pseudogenes should fit into the creation model.

Darwinian evolution has been defended by arguing that genomes are composed of pseudogenes and junk DNA that could not possibly be the result of direct creation by God. Creationists state that pseudogenes are the result of degenerative processes beginning after the Fall, and have also correctly predicted that functions for the supposed 'junk' DNA would be discovered. However, two reasons exist for why the creation model also predicts non-functional parts of the genome. After the Fall and consequent advent of death in the world, a biological mechanism for death must have appeared. Genome decay (which leads to non-functional parts of the genome) may be part of this mechanism. The second reason is that God designed kinds to diversify and fill the earth. As the kinds diversified, some of the original genetic information God included in the kinds was no longer

needed and therefore may now be absent through processes of gene loss. This can also give rise to non-functional parts of the genome. The goal of this paper is to describe current understanding of pseudogenes in light of the creation model.

Bacteria serve as a good model to study pseudogenization due to several of their characteristics: because of their short generation time and large population size, they can be easily studied. Furthermore, because they are haploid, the effects of genes loss readily become evident.

The process of pseudogenization

Pseudogenes can undergo different kinds of mutations which are more or less deleterious to the function of the genes. They usually contain premature stop codons, meaning that while the full length protein cannot be formed, the truncated mRNA can still function as a regulator of the original gene.⁴ Pseudogenization is the process of gene death whereby mutations accumulate within a gene, resulting in that gene losing its original function. During this process, the pseudogene region may still be active and functional, albeit at an ever diminishing expression level. Even if the pseudogene itself is not actively translated, it still can be transcribed, as recent studies have shown that many pseudogenes take part in siRNA-mediated gene silencing.^{5,6} In eukaryotes, pseudogenes often form an important subclass of long non-coding RNA genes and are key components of complex regulatory networks of gene expression.⁷

The definition of a pseudogene is not precise since pseudogenization is a process whereby the function of the gene diminishes or is immediately destroyed. Therefore opinions differ as to when a gene can be considered a true pseudogene. One standard is if a gene loses its regulatory region and is no longer transcribed, it is categorized as a

Table 1. Pseudogenes affecting DNA replication and repair in selected bacterial species

Species	Process	Gene name
<i>Vibrio vulnificus</i> CMCP6	Protein synthesis	Elongation factors Tu, G
	DNA replication	DNA gyrase A
	DNA replication	RuvB helicase
	DNA replication	RuvG helicase
	Protein synthesis	Ribosomal protein L5
	Protein synthesis	Ribosomal protein L35
<i>Vibrio vulnificus</i> YJ016	DNA replication	recN
<i>Mycobacterium leprae</i>	DNA repair	dnaQ
<i>Buchnera aphidicola</i>	DNA replication	recA/F
<i>Rickettsia</i> sp.	DNA repair	phrB
		radC
		mutM
		mutT
		alkylated DNA repair genes
<i>Shigella flexneri</i> 2a	DNA replication	dnaA
<i>Blochmannia floridanus</i>	DNA replication	dnaA
<i>Wigglesworthia glossinidia</i>	DNA replication	dnaA
<i>Shigella</i> sp.	DNA metabolism	Lhr
<i>Shigella</i> sp.	DNA repair	ung
<i>Escherichia coli</i>	DNA recombination	recE

pseudogene since it cannot be expressed. Further, if genes are effectively silenced by prophages or transposon disruption these are also categorized as pseudogenes.

In general, pseudogenes may also be eventually removed from the genome because of energetic costs involving continuous translation and transcription of functionless genes. However, this is not true for all genes, since DNA replication is only a minor process compared to protein synthesis, so that there is no real selective pressure against these genes. On a larger scale this coincides with genome size reduction. Microbial pathogens and endosymbionts exist at different stages of pseudogenization accompanying genome reduction.¹

The mutation accumulation required for pseudogenization can be compared to defect accumulation in an automobile. First, one headlight is broken. Then a window won't roll up. Then a spark plug fails and the engine begins misfiring. Eventually, after the accumulation of minor defects, a major malfunction will prevent the car from being able to be driven. Similarly, pseudogenization often begins with a gradual breakdown of gene functionality until a functional

domain, for example such as the active centre of an enzyme, is broken down.

Bacterial pseudogenization differs from that in eukaryotes in a number of ways. Since bacterial cells are haploid, loss of gene function is felt more readily in the phenotype, compared to diploid organisms, where mutations can be masked by functioning gene copies. In eukaryotes, transposons may deactivate only a single copy of a gene, whereas the other copy is free to function. Proviruses must also integrate into the germline in eukaryotes, and most of the genes they are inserted into must also be homozygous in order for their mutations to take effect. Furthermore, the protein coding structure of bacteria is different than in eukaryotes, meaning that available genome space is highly compact with genes lacking introns and packed tightly into operons serving as functional units. Up to 90% of the genome in bacteria is used for coding genes.⁸

In bacteria there are three main ways for pseudogenes to form: disruption by transposons, degradation preceded by duplication, and incomplete (failed) horizontal gene transfer (HGT). The latter process can be more than two times as prevalent as pseudogenization of host genes; therefore we will examine it at a closer level.⁹

Evolutionary predictions for pseudogenes

According to evolution, besides gene loss, pseudogenes could serve as raw material from which new genes are built by random mutations and natural selection, allowing simpler organisms to evolve into more complex ones. However, previous studies have shown that pseudogenes accrue over a line of related species within bacterial groups.¹ Also, entropy tends to break information down, rather than build it up.

Secondly, evolving genes could possibly be in an intermediate stage on a trajectory between random sequences and a new gene. Even if pliable proto-genes were capable of transforming into functionally new genes, they would still have to acquire whole regulatory regions (promoters, enhancers, insulators, etc.) to make them fully functional.

Lastly, pseudogenes also have to stay around long enough for mutations and natural selection to transform them into new genes. However, natural selection cannot act upon a forming pseudogene, since natural selection acts upon a whole gene as a unit. In other words, the forming pseudogene or proto-gene would have to become an entirely new gene

in order for natural selection to kick in and start having any effect on it.

Thus, upwards evolution meets a number of hurdles which are very hard for it to overcome in order to form new genetic information out of nothing in the form of a pseudogene.

Horizontal gene transfer

The most common cause of pseudogenization is the *failed* horizontal transfer of prophages, plasmids, transposons, or other conjugational elements.¹⁰ Failed HGT is 2.3 more likely to occur than the disruption of vertically inherited genes.⁹ The reason this rate is so high is that it has been estimated that the concentration of bacteriophages is about ten times as high as that of bacteria, meaning that the rate of HGT is a lot higher compared to plasmid transduction and other forms of DNA uptake from the environment.¹¹ Thus, failed HGT is a constant threat to bacteria, and eliminating such elements also causes the occasional deletion of useful DNA. A deletion rate at equilibrium thus helps streamline the bacterial genome.

Certain species of pathogenic bacteria paradoxically have a very high ratio of pseudogenes, such as *Rickettsia prowazekii* and *Mycobacterium leprae*. This is because, as intracellular parasites, their exposure to horizontally transferred genetic elements dramatically decreases. *Borrelia burgdorferi* on the other hand harbours linear plasmids, which allows unequal crossing over to increase the number of pseudogenes residing on them. Indeed the coding capacity of these linear plasmids is only 52%, which is very low compared to that of other bacteria.¹²

The nature of mutations occurring during pseudogenization

Many kinds of mutations can accumulate in a gene, thereby deactivating it. These include premature start or stop codons, loss or change of functional domain, loss of the promoter, and frameshift mutations, which cause the truncation of the gene. Such mutations can intensify if the proofreading

machinery of the bacterium is disabled, such as mutations in the genes which take part in DnaQ-mediated proofreading in DNA polymerase III in *M. leprae*,¹³ or recA/F in *Buchnera*.¹⁴ Other genes include Elongation factor Tu and G, DNA gyrase A, helicases RuvB and RecG, ribosomal proteins L5 and L35, and DNA repair protein RecN in certain *Vibrio* species.³ Several *Rickettsia* species have lost the following DNA repair proteins: *phrB*, *radC*, *mutM*, *mutT*, and two alkylated DNA repair genes.¹⁵ See table 1 for a sample list of such genes.

Premature stop codons (TGA, TAA, and TAG) may arise in the AT-enriched bacterial genomes. Indeed, pseudogenes occur in higher numbers in bacteria with high AT% values.¹⁶ Bacterial genome decay has been shown to coincide with a non-synonymous to synonymous mutation rate greater than one, with a non-random directionality towards higher AT%. For example, *Rickettsia* species have a mean AT% of 68.3%, and a mean coding capacity of 75%. Even interruption of ORFs is not necessarily detrimental to a gene's 'health'. Thirty-seven genes in the genome of *Rickettsia conorii* have been observed to be split into 105 fragments, of which 59 continue to be expressed, at least on a minimal level.¹⁷

A summary of different kinds of pseudogene mutations can be seen in table 2.

Pseudogenization as adaptation to a new host environment

Bacteria can transition to a new host environment involving either an obligate symbiotic or pathogenic lifestyle. The event itself of this transition renders genes necessary for nutrients already provided by the host organism superfluous, as well as accumulation of deleterious mutations due to the decrease of effective population size and relaxation of selection, when the species is restricted to a single individual host organism as its environment.³

Massive genomic changes occur during this process, also involving pseudogenization. As an example, the proteomes of *Mycobacterium tuberculosis* and *leprae* have been compared with each other, showing that approximately 1,000 genes have been corrupted in *leprae* as compared to tuberculosis.

During further genomic decay, pseudogenes are randomly deleted, rarely being shared between even closely related species, signifying complete loss of function. Despite lack of pressure for genes to remain in the genome, the proportion of pseudogenes is about the same in non-pathogenic and pathogenic bacteria, as well as archaea (3.9%, 3.3%, and 3.6%).⁹

We also studied the ratio of pseudogenes to all genes for 45 bacterial species (11 free-living, 31 pathogenic) taken from the Pseudogene.org database.¹⁸ By checking the number of genes for

Table 2. Different classes of mutations during the pseudogenization process

Type of mutation	Frequency	Severity
Non-synonymous base pair substitution	Infrequent	Not severe
Base pair insertions	Infrequent	Disruptive
Frameshift mutation	Frequent	Very disruptive, lethal
Premature stop codon/truncation	Frequent	Very disruptive
Loss of promoter	Infrequent	Lethal
Transposon/prophage disruption	Very frequent	Very disruptive, lethal

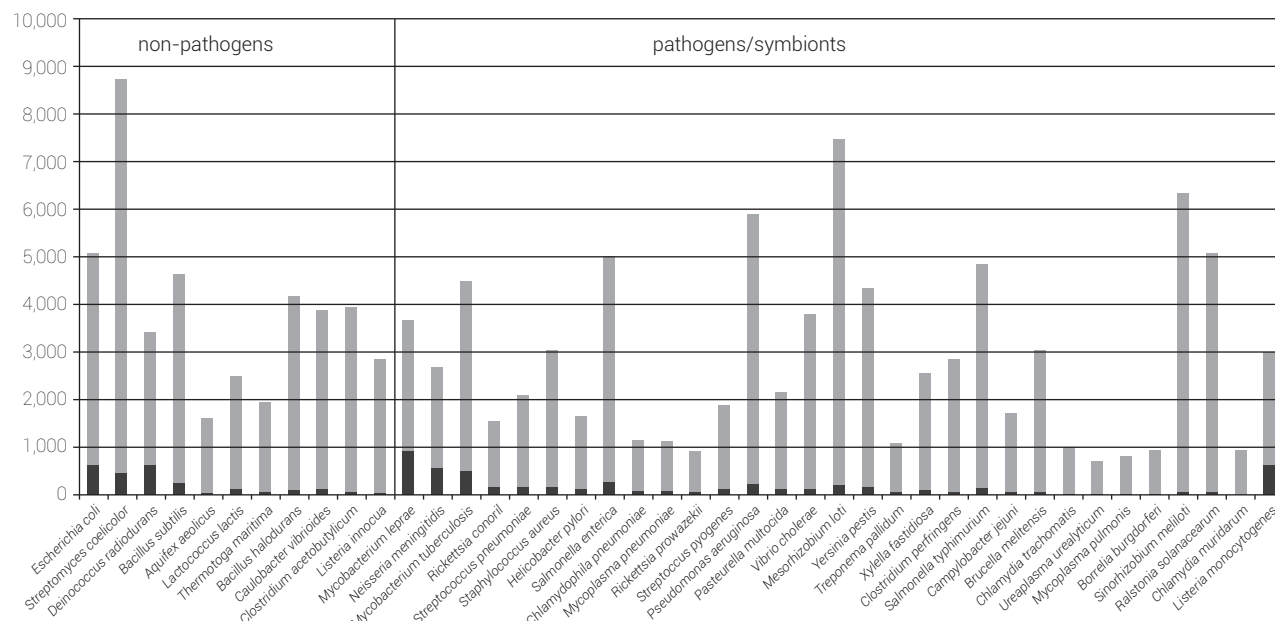


Figure 1. Number of common pseudogenes between pairs of species from the same baramin from the Pseudogene database

each species at NCBI we found that, on average, 3.51% of the genes of non-pathogenic bacteria were pseudogenes (std. dev. 3.09), whereas on average 4.41% of genes of pathogenic bacteria were pseudogenes (std. dev. 5.45). The difference of pseudogene ratios between the two groups proved to be insignificant even at the 10% level, based on a t-test which was performed between the pathogenic and non-pathogenic bacteria. The number of true genes and pseudogenes for each of these 46 species can be seen in figure 1. An important conclusion of this study is that bacterial genomes lose genes through pseudogenization, whether they are pathogenic or not. This means that genomic decay is an inherent process to organisms, irrespective of pathogenic status. This points to devolution and not evolution.

The degree of host specificity also correlates with the number and specific type of pseudogenes accrued in genome decay. *S. Gallinarum* and *S. Pullorum*, which infect birds, have 231 and 212 pseudogenes, respectively. Twelve of 15 metabolic pathways are affected by the same set of pseudogenes in both serovars before their divergence. *S. Dublin*, which is associated, but not exclusively, with cattle has only 95 pseudogenes.¹⁹ This is an example of how bacterial species colonizing the same host undergo a similar trajectory of gene loss through pseudogenization to members of the same baramin which infect/colonize other host species. Examples of pseudogenes in several cultivars of *Salmonella*, mobile genetic elements called *Salmonella* pathogenicity islands (SPI), are accumulated, which encode type VI secretion systems. Loss of some of these elements as well as the pseudogenization of fimbriae proteins led to host adaptation.

The age distribution of pseudogenes

In a study of several *Salmonella* genomes, Kuo *et al.*²⁰ studied 378 pseudogenes, of which 364 (96.3%) were shown to have a single deactivating mutation. This indicates that these pseudogenes are very young, whereas pseudogenes with more inactivating mutations are rare. Kuo *et al.* found that this is because the single mutation pseudogenes had a lot more interaction partners. Since they had a relatively higher connectivity, their loss would have been much more detrimental to the organism, and would have been quickly removed, as opposed to multiple mutation pseudogenes, which were shown to have a lot lower connectivity, and thus persisted much longer in the genome. This concept of synergistic epistasis has not been proven and is only a theoretical speculation. This also poses a further problematic question: if the majority of potential pseudogenes are so highly connected (implying that they have necessary function), then how is that so many genes would be lost due to relaxation of selective pressure upon entering a host?

Pseudogenes can arise quite quickly, as seen in the case of five *Shigella* species: ²¹*Shigella boydi*, *dysenteriae*, *flexneri* 2a, *flexneri* 5, and *sonnei*. *Shigella dysenteriae* had almost twice the number of pseudogenes (432) as *sonnei* (219). Furthermore, the two very recently diverged *flexneri* strains (2a and 5) have 17 and 14 strain-specific pseudogenes, respectively, as well as 14 and 10 strain-specific truncated pseudogenes, respectively. Bacterial strains have been known to diverge from each other fairly rapidly, implying that pseudogenization is a rapid process and that these pseudogenes are quite young.

Table 3. Number of common pseudogenes between pairs of species from the same baramin from the Pseudogene database

Species 1	Number of pseudogenes	Species 2	Number of pseudogenes	Number of common pseudogenes
<i>B. halodurans</i>	67	<i>B. subtilis</i>	214	1
<i>C. muridarum</i>	6	<i>C. trachomatis</i>	11	2
<i>C. acetobutylicum</i>	37	<i>C. perfringens</i>	45	1
<i>L. innocua</i>	11	<i>L. monocytogenes</i>	9	2
<i>M. leprae</i>	888	<i>M. tuberculosis</i>	363	33
<i>M. pneumoniae</i>	47	<i>M. pulmonis</i>	9	0
<i>P. abyssi</i>	54	<i>P. horikoshi</i>	72	7
<i>R. conorii</i>	142	<i>R. prowazekii</i>	40	4
<i>S. enterica</i>	222	<i>S. typhimurium</i>	86	49
<i>S. pneumoniae</i>	110	<i>S. pyogenes</i>	63	3
<i>S. solfataricus</i>	168	<i>S. tokodaii</i>	117	24
<i>T. acidophilum</i>	41	<i>T. volcanicum</i>	81	1
<i>T. acidophilum</i>	41	<i>U. urealyticum</i>	8	0
<i>T. volcanicum</i>	81	<i>U. urealyticum</i>	8	0

We analyzed the common pseudogene content of 25 species of bacteria and archaea from 12 baramins from the Pseudogenes database. There were usually 2–3 species only from each baramin. These interbaraminic species-wise pseudogene content comparisons can be seen in table 3. As we can see, in many of the groups, much of the pseudogene content has diverged. Only *Mycobacterium*, *Pyrococcus*, *Salmonella*, and *Sulfolobus* have a substantial number of pseudogenes in common (3.7–9.1%, 9.7–13.0%, 22.1–57.0%, and 14.3–20.5%, respectively).

The high number of shared pseudogenes between two species may be the result of their colonization of the same host (representing a uniform environment), as in the case of *S. enterica* and *S. typhimurium*, which have 22–57% of their pseudogenes in common. Otherwise, different species living in different environments (such as two wild type species or one wild type species and one pathogen) may undergo different selective pressure, thereby losing different genes. *B. subtilis* and *B. halodurans*, on the other hand, are both free-living soil bacterium species, and have only one pseudogene in common. *C. acetobutylicum* and *C. perfringens* are also examples of a soil-living bacterium and a pathogen which have only one pseudogene in common. Also, *C. muridarum* infects lung tissue in mice, whereas *C. trachomatis* infects the eye and urogenital tract in human (different species, different tissues), and have only two pseudogenes in common.

Pseudogenes in archaea

It has been reported that relative to eukaryotes, deletions occur more frequently than insertions in both archaea and eubacteria. Further, the incidence of deletions is higher in archaea than in eubacteria. For example, the ratio of insertions to deletions was observed to be 0.07 in *Geobacter* and 0.9 in *Wolbachia*.²² This deletion bias prevents a net gain of genetic information over time. In archaea, the coding fraction of the genome is higher than in eubacteria, with only 0.3% to 8.6% of the genome residing in pseudogenes in 15 species studied by van Passel.²³ Archaeal genes also contain more inactivating mutations (more than three times as many) on average than eubacteria. Also, strand slippage due to mononucleotide repeats is more of a cause of mutagenesis in bacteria than in archaea, due to its association of immune evasion of

pathogenic bacteria.²⁴ Furthermore, truncation as a cause of pseudogenization is more prevalent in archaea than in eubacteria, with up to 30% of all archaeal pseudogenes formed in this manner.

Taken together, archaea and eubacteria are fundamentally different with respect to pseudogene content and possible pseudogenization mechanisms, which implies a separate origin of these two groups of organisms (apobaramins). Table 4 lists these differences in pseudogenization between archaea and bacteria.

Conclusion

Bacterial pseudogenes may indeed have functions, because many of them are shared between several unrelated or distantly related bacterial species. This conservation between species implies function and, as such, proves designed genomes. If they did not have any function, such as the 1,100+ pseudogenes in the genome of *M. leprae*, they would have been quickly removed from the genome. Further, due to their haploid state, the process of pseudogenization in bacteria is distinctly different from that in eukaryotes. The functionality of pseudogenes is more obvious in bacteria, since in eukaryotes, which are diploid, a still fully functioning version of the gene would mask the pseudogenized allele of that gene.

Table 4. Differences and similarities in pseudogenization between archaea and bacteria

Characteristic	Bacteria	Archaea
Pseudogene fraction	Up to 50%	<10%
Average pseudogene to total gene ratio	3.5–3.9% non-pathogenic, 3.3–4.4% pathogenic	3.6%
Insertion to deletion ratio	Higher	Lower
Number of inactivating mutations per gene	Lesser	Greater
Strand slippage due to mononucleotide repeats	Greater	Lesser
Truncation as a cause of pseudogenization	Lesser	Greater

Obviously, the wide extent of species-specific pseudogenes, as well as the observed deletion-bias, poses a problem for evolutionary theory. Pseudogenization is an ongoing process not only in pathogenic bacterial species (where there is no need to retain genes), but in non-pathogenic species as well, since, according to two studies, there is no statistically significant difference in the proportion of pseudogenes to all genes in these two groups. Pseudogenes are also known to accumulate in free-living bacterial species as a part of genome degradation.³ This may have serious consequences for grand scale evolutionary theories, since the deletion bias renders it impossible to transform smaller prokaryotic genomes into larger eukaryotic. However, it fits the picture that genetic information is gradually degraded, pseudogenized, and eventually lost from the genome.

The creation and distribution of pseudogenes within bacterial baramins fit well with the baranome model of Peer Terborg.²⁵ According to this model, baranomes are pluripotent, undifferentiated, uncommitted genomes representing a single holobaramin. Speciation and adaptation may now occur due to their genome shuffling, loss of redundancy, and transposable elements activity (coined: variation-inducing genetic elements). The environment determines to what extent the frontloaded genetic programs are being preserved. Thus, the way certain bacteria adapt to a new host environment directly determines which genes become fixed (conserved by selection) and which degrade into pseudogenes (due to lack of selection). As we have seen, 1,456 genes have differentially pseudogenized in five species representing the *Shigella* baranome.²¹ In seven *Rickettsia* species 1,252 genes have differentially pseudogenized, with 100–274 genes specifically lost to each species, which are well-known pathogens.²⁵ A study of *Salmonella enterica* serovars showed that 66 pseudogenes were common to serovars *S. paratyphi A* and *S. typhi*, which contained common inactivating mutations. Twenty of the shared pseudogenes encoded surface proteins, indicative of host interactions and thus environment-induced conservation.²⁶ A similar study of 19 *S. typhi* strains showed that their last common ancestor had

180 pseudogenes, whereas individual isolates of diverged successors had 10–28 additional pseudogenes.²⁷ The results presented in this study further demonstrated that in some baramins a large part of their pseudogenes can be held in common, whereas in other baramins, species-specific pseudogenization can be fairly rapid. This may reflect distinct biological mutational mechanisms, as well as distinct environmental constraints.

Overall, as a response to the original problem posed in the introduction about the possible functionality of bacterial pseudogenes, we can say that pseudogenes are themselves a microcosm of genomic decay. A subset of pseudogenes may be functional, but accumulation of inactivating mutations eventually renders them functionless. Their species-specific restriction within baraminic boundaries further supports the baranome theory. All of this supports devolution rather than upwards evolution.

Materials and methods

Bacterial pseudogene information (species, DNA, and protein sequence), among others, was retrieved from the Pseudogene.org database from the following file: pseudogene.org/prokaryotes/All_Prokaryotic_pseudogenes.txt. The number of pseudogenes was tallied for each bacterial species. The number of genes for bacterial species was retrieved from the following NCBI webpage: www.ncbi.nlm.nih.gov/genome. A given bacterial species was classified as pathogenic, non-pathogenic, or symbiotic according to the species description in their NCBI genome description page.

The Linux version of NCBI BLAST was used to identify the pseudogenes of 25 species of bacteria and archaea classified into 12 different baramins (shown in table 3) present in the Pseudogene database and compared against each other. Since we were dealing with pseudogenes which have diverged from each other sequentially, two pseudogenes were counted as a match with each other if they were at least 75% identical throughout at least 50% of their alignment with each other.

Acknowledgments

The author would like to thank Robin M. Wyle and both reviewers for critically reading the paper and Robin Wyle for generating the data for table 3.

References

- O'Micks, J., Bacterial genome decay from a baraminological viewpoint, *J. Creation* **29**(2):110–118, 2015.
- Pei, B., Sisu, C., Frankish, A. *et al.*, The GENCODE pseudogene resource, *Genome Biol.* **13**(9):R51, 2012.
- Lerat, E. and Ochman, H., Recognizing the pseudogenes in bacterial genomes, *Nucleic Acids Res.* **33**(10):3125–3132, 2005.
- Watanabe, T., Cheng, E.C., Zhong, M. and Lin, H., Retrotransposons and pseudogenes regulate mRNAs and lncRNAs via the piRNA pathway in the germline, *Genome Res.* **25**(3):368–380, 2015.
- Jerlström, P., Pseudogenes, are they non-functional? *J. Creation* **14**(3): 14–15, 2000.
- Sasidharan, R., Gerstein M. Genomics: protein fossils live on as RNA, *Nature* **453**(7196):729–731, 2008.
- Tomkins, J.P., Extreme Information: Biocomplexity of Interlocking Genome Languages, *CRSQ* **51**:187–201, 2015.
- Lawrence, J.G., Hendrix, R.W. and Casjens, S., Where are the pseudogenes in bacterial genomes? *Trends Microbiol.* **9**(11):535–540, 2001.
- Liu, Y., Harrison, P.M., Kunin, V. and Gerstein, M., Comprehensive analysis of pseudogenes in prokaryotes: widespread gene decay and failure of putative horizontally transferred genes, *Genome Biol.* **5**(9):R64, 2004.
- Fuxelius, H.H., Darby, A.C., Cho, N.H. and Andersson, S.G., Visualization of pseudogenes in intracellular bacteria reveals the different tracks to gene destruction, *Genome Biol.* **9**(2):R42, 2008.
- Wommack, K.E. and Colwell, R.R., Virioplankton: viruses in aquatic ecosystems, *Microbiol. Mol. Biol. Rev.* **64**(1):69–114, 2000.
- Hinnebusch, J., Bergström, S. and Barbour, A.G., Cloning and sequence analysis of linear plasmid telomeres of the bacterium *Borrelia burgdorferi*, *Mol. Microbiol.* **4**(5):811–820, 1990.
- Coleman S.T., Eiglmeier K., Parkhill J. *et al.*, Massive gene decay in the leprosy bacillus, *Nature* **409**(6823):1007–1011, 2001.
- Goodhead, I., and Darby, A.C., Taking the pseudo out of pseudogenes, *Curr. Opin. Microbiol.* **23**:102–109, 2015.
- Blanc, G., Ogata, H., Robert, C. *et al.*, Reductive genome evolution from the mother of Rickettsia, *PLoS Genet.* **3**(1):e14, 2007.
- Moran, N.A., Microbial minimalism: genome reduction in bacterial pathogens, *Cell* **108**(5):583–586, 2002.
- Ogata, H., Audic, S., Renesto-Audiffren, P. *et al.*, Mechanisms of evolution in *Rickettsia conorii* and *R. prowazekii*, *Science* **293**(5537):2093–2098, 2001.
- Karro, J.E., Yan, Y., Zheng, D. *et al.*, Pseudogene.org: a comprehensive database and comparison platform for pseudogene annotation, *Nucleic Acids Res.* **35**(Database issue):D55–60, 2007.
- Langridge, G.C., Fookes, M., Connor, T.R. *et al.*, Patterns of genome evolution that have accompanied host adaptation in *Salmonella*, *Proc. Natl Acad. Sci. USA* **112**(3):863–868, 2015.
- Kuo, C.H. and Ochman, H., The extinction dynamics of bacterial pseudogenes, *PLoS Genet.* **6**(8):e1001050, 2010.
- Feng, Y., Chen, Z. and Liu, S.L., Gene decay in *Shigella* as an incipient stage of host-adaptation, *PLoS One* **6**(11):e27754, 2011.
- Kuo, C.H. and Ochman, H., Deletional bias across the three domains of life, *Genome Biol. Evol.* **1**:145–152, 2009.
- van Passel, M.W., Smillie, C.S. and Ochman, H., Gene decay in archaea, *Archaea* **2**(2):137–143, 2007.
- van der Woude, M.W. and Bäumler, A.J., Phase and antigenic variation in bacteria, *Clin. Microbiol. Rev.* **17**(3):581–611, 2004.
- Terborg, P., Evidence for the design of life: part 2—Baranomes, *J. Creation* **22**(3): 68–76, 2008.

- Holt, K.E., Thomson, N.R., Wain, J. *et al.* Pseudogene accumulation in the evolutionary histories of *Salmonella enterica* serovars Paratyphi A and Typhi, *BMC Genomics* **10**:36, 2009.
- Holt, K.E., Parkhill, J., Mazzoni, C.J. *et al.*, High-throughput sequencing provides insights into genome variation and evolution in *Salmonella typhi*, *Nat. Genet.* **40**(8):987–993, 2008.

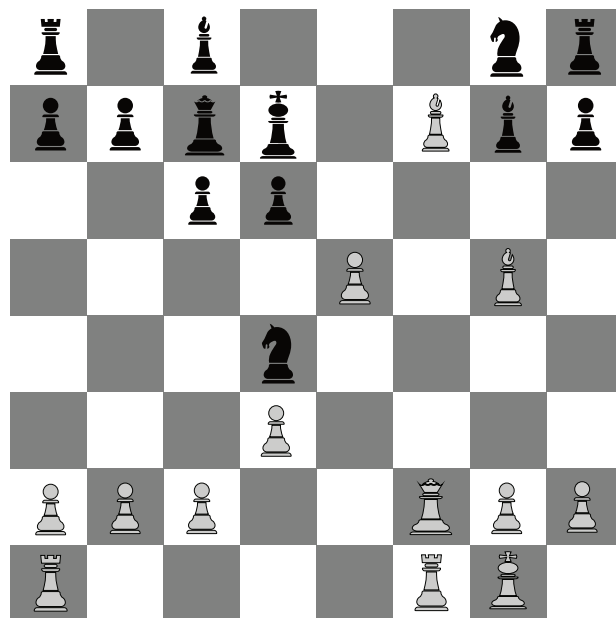
Jean O'Micks has a Ph.D. in biology. He has been an active creationist for 11 years and takes a great interest in molecular biology. He has published a number of articles in *Journal of Creation*.

Errata

J. Creation 29(3)

Royal Truman, Nylon-eating bacteria—part 4: interpretation according to Coded Information System theory

The chess problem in figure 3 on p. 83 should be as follows:



Languages of the post-Diluvian World

Murray R. Adamthwaite

Evolutionary theory, when applied to origins of language, fails utterly to explain the phenomena of original complexity, subsequent loss and degeneration, and the array of unrelated languages in antiquity that even now are only partially understood due to that complexity. It is here contended that only a biblical approach can explain the complicated grammar, morphology, phonetics and syntax found in ancient texts. From what we in fact find from these texts, and because these phenomena could not arise spontaneously or gradually, a supernatural interruption near the beginning of post-diluvian history is the only explanation. The supernatural interruption which created these many complex languages is precisely what is related in Genesis 11:1–9.

The origin of languages poses a major problem for evolutionists, and in the wake of Darwin's *The Origin of Species*, published 1859, speculation became rife—and ridiculous—as to this matter. So outlandish were these speculations that the *Société de Linguistique de Paris* placed a ban on all discussion of the subject, which prevailed for more than a century.¹ However, the challenge is now on for evolutionists to explain how man came to be a verbalizing creature who can communicate meaningful information through language, as Christiansen and Kirby remark:

“The recent and rapid growth in the literature on language evolution reflects its status as an important challenge for contemporary science.”²

However, this study, as well as many others, indicates that evolutionary science seeks for answers in primitive ‘symbols’, with experiments with African monkeys and other subhuman primates to ascertain (it is hoped) meaningful communication by animal gestures and signals (figure 1³). Since they are committed to the view that language itself began with grunts and noises from evolutionary ape-like creatures through gestures or some kind of referral,⁴ they are likewise committed to the view that language evolution came concurrently with biological evolution. Thus the simple grunts in response to, say, the presence of predators, becomes a sequence of symbols,⁵ which in turn moves on to simple sentences such as ‘lion in grass’ or ‘bird in tree’. and so on to ever higher and more complex arrangements of words, more complex morphology and syntax, and ultimately to abstract concepts. This ‘response-to-stimulus’ scenario is, in the immediate circumstance, the philosophy of behaviourism, which even Christiansen and Kirby reflect,⁶ but is really hand-in-glove with an evolutionary approach. In view of these various theories and experiments on, and observations of, non-human primates, it is noteworthy that these authors are forced to concede:

“There is inevitable scepticism regarding whether we will ever find answers to some of the questions surrounding the evolution of language and cognition.”⁷

There are indeed several problems with this ‘grunts-to-grammar’ evolutionary scenario. One such issue is that the further back one goes in the history of language in general, and of any language in particular, the more complex it becomes. Case endings appear at the end of nouns; prefixes, infixes, and affixes are added to verbs to modify or to expand meanings; different moods (modes) of verbal inflection occur to denote different types of expression; semantic subtleties are present to distinguish one expression from another—whether in words themselves, or word endings, or in idiomatic phrases.⁸ We can illustrate this with the example of Old English (that of 1,000 years ago, as spoken in Anglo-Saxon times): it had four cases for its nouns—with remnants of a fifth, each duly inflected, plus different inflections in the conjugation of verbs.⁹ Modern English (MnE) has largely lost inflections in nouns and pronouns (even the distinction between ‘who’ and ‘whom’ is disappearing), while in verbs it has lost the distinction between second person singular and plural, and largely lost its subjunctive mood. Moreover, Old English (OE) would distinguish parts of speech more precisely, where MnE will use the same word as a verb and as a noun or adjective. Hence OE will distinguish the adjective *open* from the verb *openian*, where MnE has ‘open’ to denote both.¹⁰ Other differences of MnE from OE occur, for example, in strong and weak forms of the adjective,¹¹ inflected infinitives,¹² and two conjugated tenses (present and preterite), with resolved forms only beginning to appear.¹³ On the latter, MnE has ‘atomized’ the verb and builds tenses with either the infinitive or a participle, allied with a somewhat clumsy array of auxiliary verbs.

In summary, while Jean Aitchison concludes with a kind of ‘dynamic equilibrium’ in regard to language change, she does reject ‘language evolution’:

“Disruptive and therapeutic tendencies vie with one another in a perpetual stalemate. There is no evidence that language is evolving in any particular direction.”¹⁴

And again, citing the renowned linguist Joseph Greenberg:

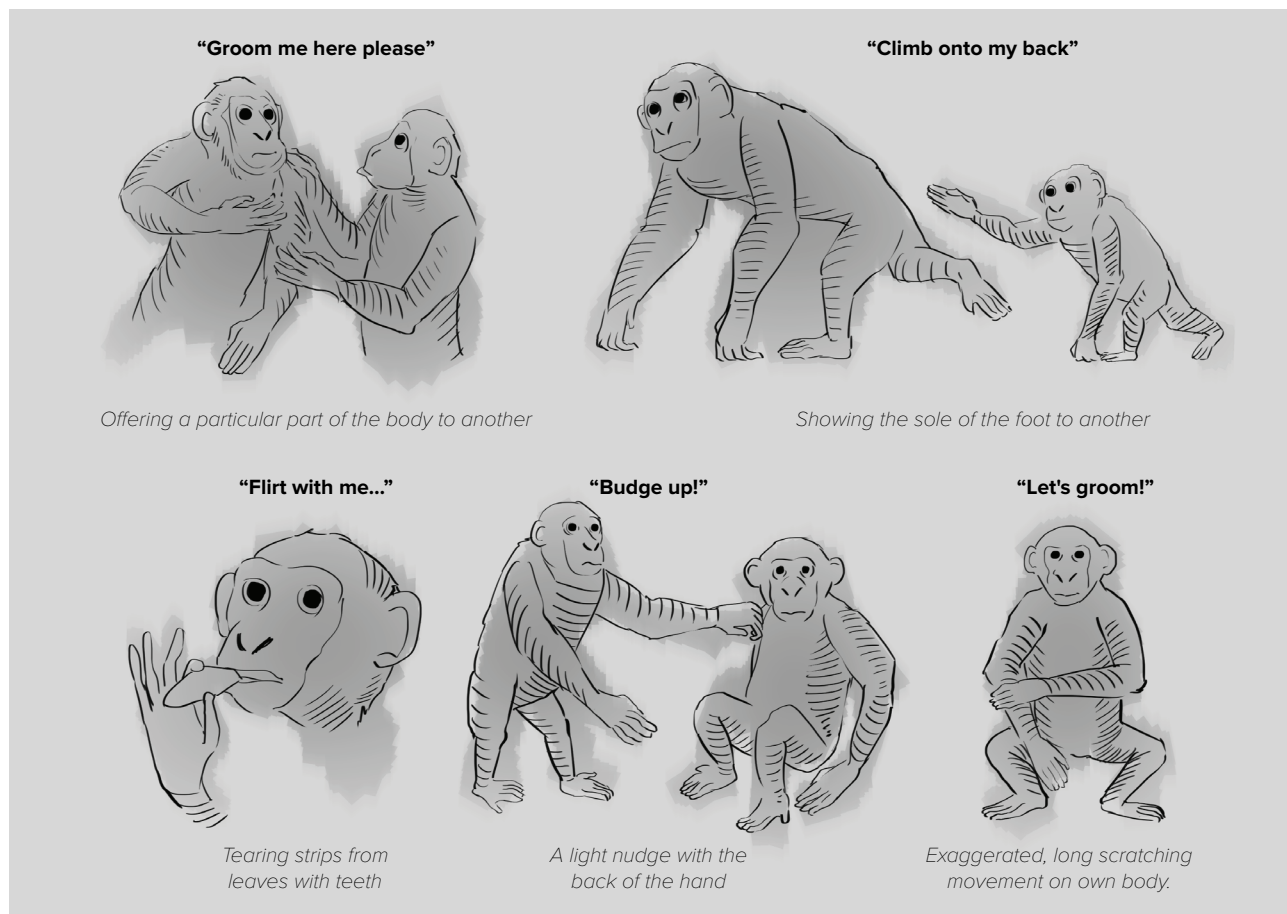


Figure 1. Diagram illustrating communication gestures of chimpanzees, from Hobaiter and Byrne.³ However, despite the authors'—and media—excitement over the results, these studies achieve little in establishing meaningful 'language' in subhuman primates.

“... the evolution of language as such has never been demonstrated, and the inherent equality of all languages must be maintained on present evidence.”¹⁵

Hence this evolutionary scenario must be seriously doubted. The general tendency is in the opposite direction.

What is complexity?

Before proceeding further, some definitions of ‘complexity’ are in order, or at least the ingredients of a definition. Recent studies have attempted to analyze the problem mathematically, with little reference to actual examples of complexity or simplicity in the languages chosen. Hence both Juola¹⁶ and Bane¹⁷ define complexity according to those aspects which can be quantified and analyzed mathematically; but without wishing to belittle these studies the question still needs to be asked, “Can language—and its complexity—be reduced to mathematics in this way?”¹⁸ Furthermore, these studies deal with contemporary languages on the plane of the present: no attempt is made to explicate any sort of historical trend to simplification. Yet, even with their approach and criteria, it

is significant that in Bane’s study, where he selects twenty languages for comparison, the most ancient language of his group, viz. Latin, comes out as the most complex, while Bislama—one of his ‘Creole’ group, appears near the bottom of his list as a very simple language, as indeed it is.¹⁹

In response to these rather abstract, not to say abstruse, exercises in quantifying and mathematical analyses of the issue, for the purposes of this study I would offer a combination of five basic criteria for complexity: economy (of words), comprehensiveness (of meaning and information), precision of expression, extent of vocabulary (including the semantic range of words and availability of synonyms), and subtleties in nuance and expression. In the last category I would put things like case endings, verbal inflections, dual and plural forms, and other such subtleties. In illustrating the first two categories, we could cite how one word in Koine Greek, εἶλεν, the imperfect of λέγω, has to be translated by at least three words in English, ‘he was saying’, or four, ‘he used to say’, or even five, ‘he was going to say’.²⁰ In particular, the combination of economy and precision is a useful guide: thus the Greek perfect of εἶρχομαι, viz. ἐληλυθα, ‘I have come’,

is actually pregnant with meaning and difficult to translate fully without being verbose. Likewise with the Akkadian perfect of the same verb, *ittalkam*.²¹

Phonemes and phonetics

Then there are differences of sound and pronunciation: within a language these differences are properly phonemic, where a phoneme is a distinctive unit in the phonetic system of a particular language. Consider in English the words ‘pot’ and, in the reverse spelling, ‘top’: in the first example the ‘p’ is the plosive labial while the ‘t’ is the emphatic dental; then in the second the ‘t’ is the plosive dental, while ‘p’ is the emphatic labial. One way of expressing the difference is the contrastive sound unit in the mind of the speaker on one hand and the sound(s) actually pronounced as represented in the phonetic notation on the other. The latter are phonetic variations of the basic phoneme. Furthermore, the speaker will not always be aware of the phonetic variations of the phonemes of his own language. As illustrated in the two words above, the phoneme /p/ covers for two sounds, and likewise for /t/. Now these subtle phonetic differences, present in various ancient languages in their earliest stages, will disappear in the subsequent history of those languages.

In regard to the phonemic structure of, for example, classical Semitic languages, they can indeed at times be very subtle: there are at least two different ‘t’ sounds, at least two different glottal stops, five different sibilant or ‘s-type’ sounds and so on. The exchange of one closely related sound for another within a word can alter its meaning completely. For example, in Hebrew *sar* (with the letter ס, ‘samech’) is an adjective meaning ill-humoured or peevish; *šar* (with the letter ש, ‘šīn’, a somewhat different sound²²) is a noun meaning ‘a chief, prince, or commander’. Then in Ugaritic the verb ‘ly means ‘to go up’, while a similar verb with a slightly different initial sound (but in the same laryngeal category), *ġly*, means ‘to lower’. In Akkadian *tebû* means ‘to arise, set out’; then *tebû* (emphatic ‘t’) means ‘to sink, submerge’. However, these phonetic subtleties are often lost in the history of a language, as previously contrasting sounds or phonemes are collapsed into one phoneme.

Thus when we compare, for example, biblical Hebrew with Modern Hebrew, we soon discern that the distinction between the emphatic ‘t’ (ט) and normal plosive ‘t’ (ת) has largely disappeared; likewise the distinction between the glottal stops ‘aleph (א) and ‘ayin (ע), and that between *samech* and *šīn*.

Japhetic, Semitic, and Hamitic languages

Another problem for the evolutionist concerns the profound differences of structure between the basic language

groupings. A point of interest arises here: philologists, no matter how secular, for a long time classified languages as Semitic, Hamitic, and Japhetic, after the sons of Noah. That is not to say that they believed in a Noahic Flood, or in the biblical account of Noah’s family. These designations are partly the legacy of tradition, yet, that said, secularists in the past recognized that the early history of the Ancient Near East²³ reflected (for them, only in a broad sense) the dispersion of nations in three basic streams as in Genesis 10, at least as far as language classification is concerned. Thus Japhetic referred to the Indo-European language family, Semitic to the languages of the Near East, and Hamitic to those of Egypt and Africa. However, in more recent years this threefold linguistic stream has tended to disappear, since there are more early languages than this basic scheme would indicate, as indeed is the case, since we find a plethora of unrelated languages in the very ancient world, as will be observed below. However, this should not be seen as contradictory to the biblical statements that the descendants of Japheth, Ham, and Shem spread abroad, “each according to their languages” (Genesis 10:5, 20, 31).

Greek and Latin belong to the Indo-European family; so too does Hittite, although the decipherment of the cuneiform script and its classification as Indo-European came as a shock to the system for Near Eastern scholars. Meanwhile, Linear B, since its decipherment by Michael Ventris, has been clearly recognized as an early form of Greek, a discovery which also upset the hitherto fond theories of scholars. The still earlier Linear A presents an outstanding puzzle which no-one to date has yet cracked, although there have been several theories, ranging around whether the language could be either Semitic or Indo-European. This latter family in its earliest features is usually quite complex: case endings on nouns, and these in several declensions or sets of case endings; tense systems of verbs in multiple conjugations or verbal classes with their respective sets of verbal endings. Another feature of this language group is its ability to run consonants together, as in English with ‘tr’ (try), ‘st’ (stand), ‘gl’ (glide), even ‘str’ (strong), and so on. Semites found this difficult, even impossible, without some sort of ‘helping vowel’. While the Hittites adopted a simplified cuneiform script from Mesopotamia to write their language—which was not a good match for this precise reason (among others)—Indo-European scripts would incorporate special characters to express this ‘double consonant’ phenomenon. Hence, for example, Greek has characters or letters to represent double sounds: ξ (‘xi’, k + s), ψ (‘psi’, p + s), ζ (‘zeta’, d + z).

However, when we move to the Semitic world of the Ancient Near East this language family has a different structure altogether. While it still has the standard parts of speech (nouns, adjectives, verbs, adverbs, etc.), the basic structure of these parts of speech derives from what is called

tri-literality, i.e. that three consonants or radicals make up a root word, which is inflected with differing vowels, or modified with affixes, infixes, and suffixes to form various verbal stems, nouns, adjectives, and even prepositions. Then the way of dealing with a verb is quite different from the treatment by the Indo-European family with the latter's tense systems, or at least quasi-tense systems.²⁴

Semitic verbs express the quality of an action (known as an aspect system) rather than when it was done, i.e. whether the action is complete or incomplete. Concerning the Akkadian verbal system, which has a present, a preterite, a perfect, and a stative, Ungnad comments as follows:

"Originally Akkadian probably had no true 'tenses' in the traditional sense. Rather it distinguished actions that were punctiliar or durative in their aspects."²⁵

Huehnergard comments in similar fashion:

"As will be seen from the descriptions that follow ... the term 'tense' for the Preterite, Durative, and Perfect is inadequate. None of these forms is limited to a single time value, and all involve certain aspectual notions such as (non-)duration of action and present relevance of action."²⁶

A similar observation applies to Hebrew, with its perfect and imperfect. To quote one grammarian:

"Each verb pattern has two aspects: a perfect and an imperfect." To which he adds a note, "These are commonly called 'tenses'; but 'tense' is a misnomer, since the perfect and imperfect do not denote *time* of action or state so much as *type* of action or state [emphasis in original]."²⁷

The verb is modified in meaning by infixing (or prefixing) a 't', or prefixing an 'N' to make it reflexive or passive; adding an 'H' or a 'Š' (pronounced 'sh') to make it causative ('have someone do something'), or doubling the middle consonant of the normal three-consonant verb either to intensify its meaning (whereby, for example, 'break' becomes 'shatter'), or again to make it causative.

Language development—complexity followed by loss

To see this pattern of original complexity, a survey of the some of the main languages of far antiquity is in order here.

We begin with *Sumerian*, the original *lingua franca* of Mesopotamia, at least as far as textual attestation is concerned, died out as a spoken language around the turn of the Third to the Second millennium BC. Old Assyrian and Old Babylonian, dialects of Akkadian, replaced Sumerian, but the latter remained as a classical literary language in the scribal schools, much as Latin continued for centuries in the schools and universities of Europe after the fall of the Roman Empire.

Sumerian, for its part, has interesting features. As a spoken language in the Third Millennium BC, the Sumerians developed for it the cuneiform script, later taken over by the Akkadians for writing their own language. This language is classified as agglutinative, i.e. where morphemes or units of meaning—a nominal or verbal base expressed as simple syllables—string together to form larger words equivalent to phrases, and even whole clauses and sentences (in other languages); for example, *ha-ma-ab-šum-mu* means, 'he should give it to me'.²⁸ With the addition of prefixes, suffixes, reduplications, etc., such aggregations can become enormously complex, as for instance in the following two-word example:

me-lim₃-nam-lugal-la mu₄-mu₄-da-zu-ne: 'when you robe yourself with the splendour of kingship'.²⁹

When we say Sumerian is complex that is not a subjective judgment as to whether it is difficult (or easy) for person X to learn, but is so in its structure, its inflections and categories. We can see this, for example, in the Sumerian noun with its ten cases (!),³⁰ and then its number which has at least five categories (singular, non-singular, plural, collective, detailed, etc.). Pronouns have the standard three persons, but also class (personal and non-personal), as well as number and case. And this is only the beginning (of sorrows). It is all so fiendishly complex that even now it is only about 75% understood, especially as regards the verb with its *hamtu* and *maru* stems, over which debate still continues.³¹ Remember that this is the earliest attested language of Mesopotamia (figure 2). Yet we are expected to believe that all this nuanced complexity had its ultimate origins in irrational grunts and noises from evolutionary brutes in response to external stimuli!

In regard to *Akkadian*, this Semitic language is a case in point as to the loss over time of the history of these various ancient languages. Subtleties of expression, fossilized verb forms which have lost their meaning, and distinctions in noun and pronoun forms together illustrate the pattern of loss. Hence, for example, by the end of the Old Babylonian period (conventionally 1600 BC) mimation (a final 'm' on singular and feminine plural nouns, pronouns, and verbal infinitives) is lost, leading to a loss of distinction between certain pronoun forms and verbal endings. Akkadian originally had a dual form as well as singular and plural, but this too died out with the passage of time. The ventive ending on verbs—conventionally understood as expressing reverse direction in verbs of motion—remained as a fossilized form while over time its meaning evaporated.³² Another loss was in initial 'w' words, such that *wardum*, a male slave, became *ardu*. Later on, the distinction between genitive and accusative case was lost in both singular and plural, while the infix 't' in verbs to indicate a reflexive or a passive (an infrequent form at the best of times) eventually disappeared.³³

The West Semitic languages, such as Ugaritic, Phoenician, Aramaic, and Hebrew, continue, on analysis, to show various complexities and nuances, especially regarding moods and stems of verbs, which this short article cannot enumerate. Suffice it to say that what English can only express by a string of pronouns and auxiliaries with the relevant verb, a Semitic verb can express in one word, or at most two. The same goes for Akkadian.

Then there is the *Egyptian* of Pharaonic times, which has its own set of complications. For a start the phoneme /h/, occurs in four contrastive sounds, varying as h, ḥ, ḥ, and ḥ, in order of harshness of sound, yet there is no 'l' sound. The verb system displays tenses (rather than aspect), as does English, but there is a past relative form to express what other languages would indicate with a relative pronoun plus a normal finite verb, and this form occurs quite commonly.³⁴ Egyptian expresses a passive voice by participles such as 'beloved', 'justified', 'revered', etc.,³⁵ but when we come to Coptic, the Egyptian of Graeco-Roman times, the passive voice has disappeared altogether—yet another example of the decline and disappearance of linguistic forms.³⁶

Hurrian, spoken in Northern Mesopotamia and the Jezirah region (between the Upper Tigris and Middle Euphrates), has features of both agglutination and inflection. Its noun has eight cases (possibly a ninth as well), while the verb displays features similar to Sumerian (although there is no genetic relation). Hence the verb *tan-*, 'to do', will conjugate by adding first a derivative suffix to yield *tan-uš-au*, 'I have done', then adding to that to give a relative clause, *tanušau-šše-ni*, 'what I have done ...'. Using the verb *ar-*, 'to give', we can obtain a complex expression in a single word, *ar-uš-au-šše-ni-wa-*, '... to that which I have given'. Even now Hurrian is imperfectly understood, although a fairly extensive corpus of Hurrian texts is extant.³⁷

Linguistic connection between Hurrian and the later Urartian was suggested early on (Sayce, 1890, etc.), and is now firmly established.³⁸ However, Urartian, a partly agglutinative language, does have distinctive features of its own such that it is not viewed merely as a dialect or derivative of Hurrian.

Hittite, sometimes known as Nesite, after the city Nesa, headquarters of the Old Assyrian colonies in Anatolia (Asia Minor in Roman times), was one of three Indo-European languages spoken on the

Anatolian Plateau during the second millennium BC.³⁹ It had a structure and vocabulary which can indeed be traced in the later languages of Europe, but had no relation at all to any of the other languages of the Ancient Near East. In Old Hittite its noun had eight cases in the singular, and up to six in the plural, with *-a*, *-i*, and *-u* stems, and further subdivisions for each.⁴⁰ The history of the language again shows signs of disappearance of forms, and a trend to simplification: thus two of the cases in Old Hittite, the allative and the instrumental, are all but lost in Neo-Hittite. Also, the common gender nominative and accusative, distinguished in Old Hittite, merge in Neo-Hittite.⁴¹

The verb has some agglutinative features, but inflexions of vowels and consonants are also quite evident.⁴² There are two basic conjugations, *mi-* and *hi-*, and the verbal root can be monosyllabic or polysyllabic, with prefixes, infixes, and affixes to form a complex tense system of present and preterite, with a future understood as a variation of the present. Perfects and pluperfects are formed with the auxiliary verb *har-*, 'to have', as in certain other Western languages. In all, it is also quite complex in its own right, albeit quite different from the languages of the Semitic and



Figure 2. Sumerian tablet containing an account of silver for the governor. From Shuruppak, dated c. 2500 BC, British Museum, 15826. The complex structure of the various signs was simplified over subsequent centuries.

Egyptian worlds. Study of the Hittite language still proceeds, and its complexities are continuing to unfold.⁴³

Meanwhile, the Hittite language faded away with the collapse of the Hittite Empire, persisting for a while in the small states such as Carchemish, which endured after that collapse. Yet while the official language disappeared, other similar Indo-European languages persisted: Luwian, Palaic, and the languages of the Kaska and Muski peoples, who succeeded the Hittite Empire.⁴⁴

Next in the discussion we consider *Etruscan*, the language of the inhabitants of Middle Italy prior to the coming of the Latins. In respect of archaeology their origins are obscure, albeit the story from Herodotus of a Lydian origin in the late second millennium BC has some plausibility.⁴⁵ Biblically, and ultimately, it would appear that Tiras, son of Japheth, is the ancestor of the Etruscans, Genesis 10:2.⁴⁶ Meanwhile, the language is fairly well understood, although it existed for several centuries before it was expressed in writing with a script adopted from the Greeks, who in turn adopted and adapted it from the Phoenicians. Again, the language is unrelated to any other, either from Europe or further afield. Of the 13,000 known inscriptions most are short epitaphs, while a few are longer, being religious texts or contracts.

In regard to structure, the Etruscan noun has inflections for each of five cases; however, there is no gender distinction in common nouns, only with proper names. The verb conjugates with the pronoun element included with the root, and adds *-che* to the root to form the passive. Etruscan is an economical language: unlike Hittite, it does not use auxiliaries to form perfect tenses, and adds the particle *-ri* to form a particular type of passive: that of obligation.⁴⁷ Apart from the inevitable loan words from Greek, its vocabulary is *sui generis*, albeit some words passed into Latin as the latter took over as the language of the Italian Peninsula (figure 3).

Finally in this survey of very ancient languages there are the *Indus Valley* texts. Widely regarded as indecipherable

since their discovery in the early 20th century, Barry Fells attempted a decipherment in the 1970s following methods similar to those of Michael Ventris in his work on the Linear B script. His conclusion was that the script was alphabetic, with six vowels and 24 consonants, while the language, again complex in structure, was clearly Indo-European, in turn a direct ancestor of Sanskrit.⁴⁸

One could indeed go on citing examples of ancient languages as to their complexity, their subtle nuances, their economy of words to express, at times, quite extensive

Greek	Etruscan	Etruscan	Etruscan		Value
Λ A	A	A	A	A	[a]
B	B			B	[b]
< C	γ))	C G	[k]
Δ D	δ			D	[d]
Ε E	ε	ε	ε	E	[e]
Ϝ F	φ	φ	φ	F	[w]
Ζ Z	ζ	ζ	ζ	(Z)	[z]
Η H	η	η	η	H	[h]
Θ Θ	θ	θ	θ		[t ^h]
Ι I	ι	ι	ι	I	[i]
Κ K	κ	κ		K	[k]
Λ L	λ	λ	λ	L	[l]
Μ M	μ	μ	μ	M	[m]
Ν N	ν	ν	ν	N	[n]
Ξ	ξ				[š]
Ο O	ο			O	[o]
Π P	π	π	π	P	[p]
Ρ R	ρ	ρ	ρ		[s]
Q	q	q		Q	[q]
Σ S	σ	σ	σ	R	[r]
Τ T	τ	τ	τ	S	[s]
Υ Υ	υ	υ	υ	T	[t]
Φ Φ	φ	φ	φ	V	[u]
Χ X	χ	χ			[ks]
Ψ Ψ	ψ	ψ	ψ		[p ^h]
					[k ^h]
		(ϝ ϝ)	ϝ		[f]

Figure 3. Etruscan alphabet in its various forms, with the phonetic values on the right

sentences, and in turn the gradual loss of some of these nuances over the passage of time, but the point should nevertheless be clear. What can be stated emphatically is that evolutionary theory is at a loss to explain this phenomenon of original complexity and subsequent degeneration. The most frequent expedient is to postulate earlier ‘proto-languages’: Proto-Semitic, Proto-Sumerian, Proto-Hittite, etc. Thus Huehnergard gives a table showing East and West Semitic languages branching off from a “Common Semitic” ancestor, but then admits, “Akkadian is the earliest-attested member of the Semitic family of languages”, and again, “It is not certain when speakers of Akkadian or its linguistic predecessor(s) first arrived in Mesopotamia.”⁴⁹ In other words, his “Common Semitic” is a purely hypothetical construct.

As regards any earlier form of Sumerian, Edzard admits, “The oldest reconstructable form of Sumerian dates only to about 2300 BCE, and there is a gap of at least 2,000–3,000 years between that date and the oldest comparable form of the languages under consideration”.⁵⁰ This gap, however, is hypothetical, and he elsewhere offers this sobering reminder, “Our judgment on this matter is, however, highly subjective because we know nothing of the early history of Sumerian and its sound structure.”⁵¹ Yet for all that, he still talks of a ‘Proto-Sumerian’.⁵²

When Egyptian first appears it is clearly ‘Old Egyptian’, the language spoken in the earliest phase of Egyptian history and through the Old Kingdom period. There is no ‘proto-Egyptian’. Likewise, the oldest attested Elamite text comes from the Old Akkadian period, i.e. ‘The Treaty of Naram-Sin’.⁵³ Thus when we first encounter Elamite it is precisely that—Elamite. Speculation concerning a ‘Proto-Hurrian’ likewise remains just that—speculation, despite Wilhelm’s ‘confident assertion’.⁵⁴ The same could be said for the various other ancient languages of the Fertile Crescent: there is no evidence at all that any of the postulated ‘proto-languages’ ever existed. Bonfante does not venture to talk of a ‘proto-Etruscan’, but contents himself with the simple assertion that “the Etruscans were a pocket of non-Indo-European speakers in an area where everyone else spoke an Indo-European language”.⁵⁵ The one possible exception to this scenario is the Indo-European family itself (biblically the Japhetic stream): there may have been an ancestor, a ‘proto-Indo-European’, for Luwian, Palaic, and Hittite, but even this is conjectural. In all, they are merely theoretical constructs, born ultimately of evolutionary assumptions.

An array of disparate languages

As will have been discerned already from the above discussion another striking feature of the linguistic landscape of the Ancient Near East is the number of quite disparate and unrelated languages, but like Sumerian or Hurrian each is

highly complex in its own way; several are agglutinative, like Sumerian. That they all appear on the scene at about the same time—mid-third millennium BC, and that the origins of these languages and their native speakers remain obscure is testimony to the sudden diversity and early ethnic movements of these peoples, as we would expect from Genesis 11:8–9. Some of these languages are as follows:

- Sumerian: the original language of Lower Mesopotamia, as above. It is, as seen above, an agglutinative language unrelated to any other.
- Elamite: another agglutinative language spoken in the south-western part of the Iranian Plateau. A ‘Proto-Elamite’ script (not language; figure 4) has been identified, indicating that Elamite has roots deep in the Third Millennium BC (on conventional chronology), but despite attempts to relate it to Sumerian it has no relation to any other ancient language, and is still not well understood.⁵⁶
- Egyptian: from this comes Coptic, a late form of Egyptian, and the whole Hamitic or Afro-Asian family. Apart from its highly complex script (with its determinatives, ideograms, and one-, two-, and three-consonant signs),⁵⁷ the language likewise is complex, but unrelated to those of the Semitic world, albeit many loan words came into those languages, e.g. Hebrew.
- Hurrian: the language of the Mitanni kingdom of the mid-second millennium BC,⁵⁸ the origins of which go back to earlier times. It is first attested in cuneiform texts of the late Third Millennium BC.⁵⁹ This language also has agglutinative features, and is likewise unrelated to any other ancient language.
- Hattian: the earliest language of Anatolia, of which we have only a few short texts. However, it should not be confused with the later, and unrelated, Hittite (Nesite), the Indo-European language of the Hittite Empire (see above), to which Hattian is quite unrelated. One interesting feature is the way it forms plurals, i.e. by adding a prefix, thus *binu*, ‘child’, becomes, in the plural, *lēbinu*, ‘children’.⁶⁰
- Kassite: the language spoken by a people of unknown origin who overran Babylon in the period following the sack of Babylon by the Hittite king Muršilis I (conventionally c. 1595 BC). They probably came from somewhere on the western side of the Iranian Plateau or in the Zagros Mountains. This language too is unrelated to any other, and is only partly understood due to the paucity of texts.
- Semitic Family. This resolves into three further subcategories:
- East Semitic—Akkadian and its dialects. Although Akkadian has, to some extent, a common stock of

vocabulary with West Semitic languages such as Hebrew, much of its vocabulary is distinct, while some derives from Sumerian. The Assyrian dialect of Akkadian is distinguished from its Babylonian counterpart mainly by differences of vowel structures and shortened forms of pronouns.⁶¹

- West Semitic: Aramaic, Hebrew, Moabite, Canaanite, Phoenician, Ugaritic, etc.
- South Semitic: Arabic, Ethiopic, Palmyrene, Nabataean.
- Etruscan: the language of the Italian residents prior to the Romans, who seem to have settled there during the Second Millennium BC. While the Etruscans adopted the Phoenician script (as modified by the Greeks) during the first half of the first millennium BC, the language itself predates this development by many centuries, and is also unrelated to any other Mediterranean or Near Eastern language.
- Indus Valley language: the script of this very early culture remains undeciphered, and the underlying language is consequently unknown—at least for those who reject the Fells decipherment. However, if Fells is right the language is Indo-European, and a direct ancestor of Sanskrit.
- Indo-European family: Hittite (Nesite), Luwian, Palaic, Sanskrit, Old Persian, Classical and Koine Greek, Latin, Old German. Hittite could well be seen as an ancestral Indo-European language.
- Uralic Group: this includes Hungarian, Finnish, Estonian, and other languages spoken around the Baltic region, and further east. They bear no relation, however, to the Slavic languages of Eastern Europe and Russia, while their origins lie in the mists of antiquity.
- Altaic Group: Turkish, Mongolian, Korean, Japanese.
- Sino-Asian Group: Tibetan, Burmese, Old Chinese.

The next observation is that all of these early languages above (up to and including the Indo-European family) are now long dead: they are no longer spoken, while several, such as Sumerian, Elamite, Hurrian, Etruscan, Kassite, and Hattian, are even now not fully understood, although for the first four we have a fair number of texts. What we can affirm here is that some of the vocabulary of these ancient languages passed into later languages, notably Hittite words which passed into Greek

and Latin, and from there to languages of Western Europe. Akkadian words can also be traced in either Latin or Arabic, and via these even into some modern languages, as seen in the following samples:

Sumerian words

- GAM.MAL: Akk. *gammalu*: camel, from which also we have our word, ‘camel’, the same meaning as in Sumerian.
- ÚTUL: large bowl or utility vessel; cf. Latin *ūtīlis*: useful; French *utile*: useful.

Akkadian words

muškēnu: a temple dependent; cf. French *mesquin*: paltry, destitute.

petû: to open; cf. Latin *patēre*: to be open.

qarnu: horn; cf. Latin *cornu*: horn.

ruššu: red; cf. Latin *russus*: red; English russet: red.

šamaššammu: ‘oil of plant’, i.e. sunflower oil, the English sesame derives ultimately from this Akkadian word.

Hittite words

a-ra-iz-zi: arises

e-eš-tin: to be; cf. Greek *ἐστίν*; Latin *esse*

gi-e-nu: knee; cf. Latin *genu*

i-û-kán: yoke; cf. Latin *iugum*

kwis: who?; cf. Latin *quis*

wātar: water

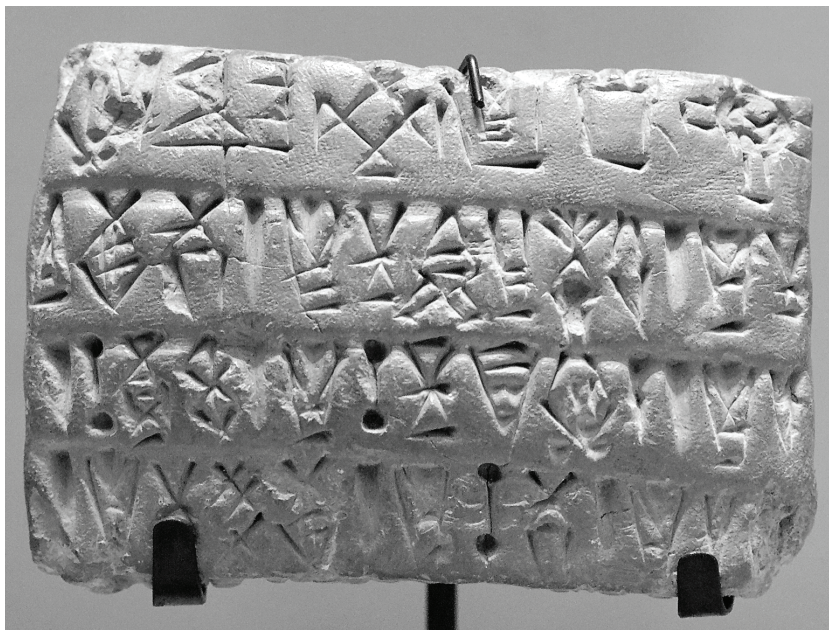


Figure 4. Proto-Elamite Economic tablet from Susa. Louvre Sb3047, by Marie-Lan Nguyen, 2009. However, the ‘proto’ refers to the primitive script, not necessarily the underlying language.

The Land of Shin'ar

Whether an occurrence in an Egyptian text of *šngr* or a similar occurrence in an Amarna letter of *Sa-an-ha-ar* refer to the biblical Shin'ar, i.e. Lower Babylonia, is disputed, the Hebrew is nevertheless clear, even if extra-biblical references are not. According to Genesis 11:2 the confusion of languages occurred in “the land of Shin'ar”, also mentioned in Genesis 10:10 and 14:1. That this name refers to Lower Mesopotamia is undoubted: the association with other known cities of that region in Genesis 10:10, and the destination of Shin'ar for the Jewish exiles in Daniel 1:2, make the identification certain.

What is important is the event. It is here proposed that the confusion of languages was a supernatural act of God which created a whole array of unrelated but highly complex languages; namely, the very languages cited and discussed above, which all appear at the same time, i.e. the second half of the third millennium BC.⁶² Contrary to what one sometimes reads in commentaries on Genesis,⁶³ these disparate languages were not a natural development from a single original over time, but a sudden, supernaturally induced change in the linguistic landscape with a resultant polyglot of languages. This is precisely what we find when we study ancient languages and their geographical distribution.

Language history from Babel

One final comment is necessary here: according to Genesis 10:5, 20, 31 the Japhethites, the Hamites, and the Semites spread abroad with their respective families and languages. These language groups fall into the familiar three streams: Japhetic or Indo-European, Hamitic or Afro-Asian, and Semitic—but these are not necessarily ethnic designations. One important subgroup here is, of course, the Canaanites, who populated the seaboard of the Eastern Mediterranean (Gen 10:19) and whose various subdivisions are those of the Jebusite, Amorite, etc., the ethnic groups we find in Canaan at the time of the conquest (cf. Genesis 15:19–21; Exodus 3:17; Joshua 24:11). Now all these groups spoke variations of Canaanite, a Semitic language akin to Hebrew, which explains why the Israelites were able to converse with the Gibeonites, according to Joshua 9:6–7. However, these various peoples descended from Ham (not Shem); nevertheless they adopted Semitic languages early on as they settled in the Levant and Palestine. What is here contended is that the Tower of Babel event produced this array of disparate but highly complex languages, which remained spoken languages for several centuries, but that they eventually died out: some sooner (e.g. Sumerian and Hattian), some later (e.g. Hurrian and Etruscan). Meanwhile, others persist, or at least their linguistic descendants do: Uralic, Altaic, and Sino-Asian groups. Meanwhile, from antiquity, the main threefold language streams of Japhetic,

Hamitic, and Semitic consolidated into the Indo-European, Afro-Asian, and Semitic families.

References

- Christiansen, M.H. and Kirby, S., Language Evolution: consensus and controversies, *Trends in Cognitive Sciences* 7(7):300, 2003. However, for all the scientific discussion and citations (69 in all), this paper is highly speculative, dependent on ‘computational modelling’ (presumably with computers), appeal to “‘fossils’ of prior, more primitive stages of language” (p. 302), and exploration of various suggested ‘perspectives’. Above all this is their concern with ‘consensus’, a strange quest given the history of science, which is replete with examples of how ‘consensus’ of scientific opinion at a particular time turned out to be wrong, e.g. the phlogiston theory of combustion.
- Christiansen and Kirby, ref. 1, p. 305.
- Hobaiter, C. and Byrne, R., The meanings of chimpanzee gestures, *Current Biology* 24(14):1596–1600, 2014.
- This itself involves the philosophy of meaning, and the ‘referral theory’ in particular—a view which is also contentious. See the discussion in plato.stanford.edu/entries/meaning/#TheRef.
- Christiansen and Kirby, ref. 1, pp. 301–302.
- Note the proposal *inter alia* of “differentially conditioned flee responses”, Christiansen and Kirby, ref. 1, p. 301.
- Christiansen and Kirby, ref. 1, p. 305.
- Note here that I am confining myself to morphological and grammatical complexity, with only occasional ventures into syntactical complexity.
- Mitchell, B. and Robinson, F.C., *A Guide to Old English*, 5th edn, Blackwell, Oxford, p. 62, 1992.
- Mitchell and Robinson, ref. 9, p. 55.
- Mitchell and Robinson, ref. 9, pp. 30–31.
- Mitchell and Robinson, ref. 9, p. 112.
- Mitchell and Robinson, ref. 9, pp. 36, 108.
- Aitchison, J., *Language Change: Progress or Decay?* 4th edn, Cambridge University Press, New York, p. 234, 2013.
- Aitchison, ref. 13, p. 240, citing Greenberg, J., The nature and uses of linguistic typologies, *International J. American Linguistics* 23(2):75, 1957.
- Juola, P., Assessing Linguistic Complexity; in: Miestamo, M., Sinnemäki, K. and Karlsson, F. (Eds.), *Language Complexity: Typology, Contact, Change*, John Benjamins, Philadelphia, PA, pp. 89–108, 2008.
- Bane, M., Quantifying and Measuring Morphological Complexity; in: Chang, C.B. and Haynie, H.J. (Eds.), *Proceedings of the 26th West Coast Conference on Formal Linguistics*, Somerville, pp. 69–76, 2008.
- As for example in the formula proposed in Bane, ref. 17, p. 73.
- Bane, ref. 17, pp. 73–74.
- For a full discussion see Dana, H.E. and Mantey, J.R., *A Manual Grammar of the Greek New Testament*, Macmillan, Toronto, pp. 186–190, 1995.
- Gperf of *alākum*, plus the ventive. See Huehnergard, J., *A Grammar of Akkadian*, Eisenbrauns, Winona Lake, p. 168, §18.1, 2005. Huehnergard is the standard grammar in this field.
- Similar to the probable original phonetic difference in English between the ‘soft c’, as in ‘ice’, and the ‘s’, as in ‘size’, albeit the difference has long disappeared.
- I am using the term ‘Near East’ in the strict sense as referring to the region covered by Syria-Palestine through to the Iranian Plateau. The ‘Middle East’ is properly the region from Afghanistan to Myanmar (formerly Burma), and the ‘Far East’ as comprising Thailand, Vietnam, China, Japan, etc. The use of ‘Middle East’ as referring to Palestine, Syria, and Mesopotamia, etc. is the erroneous creation of modern journalism and politics.
- As is well known, the verbal system of Classical and Koine Greek is properly an aspect system, with the present being continuous, or incomplete action, and the aorist a completed action; but that said, it results in what is in essence a tense system.
- Ungnad, A. (Hoffner, H.A., trans.), *Akkadian Grammar*, SBL Resources for Biblical Study 30, Scholars Press, Atlanta, GA, p. 62, 1992; note also the subsequent three pages as these forms are expounded.
- Huehnergard, ref. 21, p. 17.
- Greenberg, M., *Introduction to Hebrew*, Prentice-Hall, p. 45 and n. 1, 1965.

28. Edzard, D.O., *Sumerian Grammar*, SBL, Atlanta, GA, p. 1, 2003.
29. Edzard, ref. 28, p. 139.
30. Namely, the genitive, absolutive, ergative, dative, locative, comitative, terminative, ablative-instrumental, locative-terminative, and equative. The ergative occurs when a subject of a transitive verb exhibits a marker (i.e. the ergative case) that is different from that of the intransitive verb. See Thomsen, M.-L., *The Sumerian Language*, Akademisk Forlag, Copenhagen, p. 88, 1984. G. Rubio also concurs that Sumerian has ten cases, see Kaye, A.S. (Ed.), *Sumerian Morphology*; in: *Morphologies of Asia and Africa*, vol. 2, Eisenbrauns, Winona Lake, p. 1329, 2007.
31. Thomsen, ref. 30, p. 122, devotes nine pages of her grammar to this problem, then concludes with this statement, "I am well aware of the fact that the description of the *hamṭu* and *marū* forms given here is rather vague. However, the system of the stems as well as that of the various conjugations of the finite verb seem to be highly inconsistent and considering the fact that Sumerian verbal forms generally are badly understood ... I think that it is not possible to give a definitive answer to the question of the exact meaning and function of the *hamṭu* and *marū* stems."
32. While originally the ventive was a 1st person dative suffix ('to me'), it occurs with verbs of motion, apparently to express a reversal of direction, but it also occurs with other types of verbs, where its lexical significance is unclear. My own theory, for what that is worth, is that it represents a change of perspective, i.e. its use depends on the perspective of the narrator—hence its use with verbs of speech. However, a full discussion of this phenomenon is outside the scope of this paper. See Ungnad, ref. 25, p. 65. See also Huehnergard, ref. 20, pp. 133–134.
33. Hence in the Kurkh Monolith Inscription of Shalmaneser III (156 lines) the Gt form occurs six times, and even there four occurrences are in fossilized forms (royal titulary, and standard, 'template', accounts of battle). In the Babylonian Chronicles it occurs hardly at all. Huehnergard, ref. 21, p. 390, comments that Gt forms are 'relatively rare'.
34. Collier, M. and Manley, B., *How to Read Egyptian Hieroglyphs*, British Museum Press, London, pp. 68–69, 1998.
35. Collier, M. and Manley, ref. 34, pp. 98–99. A. Loprieno calls these forms 'statives'. See Loprieno, A., *Ancient Egyptian and Other Afroasiatic Languages*; in: Sasson, J. (Ed.), *Civilizations of the Ancient Near East* (hereafter *CANE*), IV, Scribner's, New York, p. 2146, 1995.
36. Lambdin, T.O., *Introduction to Sahidic Coptic*, Mercer University Press, Macon, GA, p. 49, 1983.
37. See Laroche, E., *Glossaire de la langue Hourrite*; in: *Revue Hittite et Asiatique*, Première Partie, pp. 26, 27, 1976.
38. Wilhelm, G., *The Hurrians*, Aris & Phillips, Warminster, pp. 3–4, 1989.
39. Bryce, T., *The Kingdom of the Hittites*, Oxford, Clarendon Press, Oxford, UK, pp. 10–11, 1998. The other two are Luwian and Palaic.
40. Hoffner, H.A. and Melchert, H.C., *A Grammar of the Hittite Language*, Eisenbrauns, Winona Lake, pp. 67–68, 79–87, 2008.
41. Hoffner and Melchert, ref. 40, p. 68.
42. Hoffner and Melchert, ref. 40, pp. 180–186.
43. See Held, W.H. Jr, Schmalstieg, W.R. and Gertz, J.E., *Beginning Hittite*, Slavica Publishers, Columbus, OH, pp. 12–26, 36ff, 48, 1987.
44. Bryce, ref. 39, p. 388.
45. Fell, J., Part 2: Barry Fells' Revolution in Deciphering Old World Scripts, 21st Century Science and Technology, Summer, p. 53, 2001. G. and L. Bonfante, cite a 6th-century BC Etruscan inscription (the 'Warrior Stele') on the island of Lemnos as possibly supporting the Asia Minor origin. However, while archaeological evidence has not so far supported the Lydian hypothesis, it remains an option. See Bonfante, G. and Bonfante, L., *The Etruscan Language*, Manchester University, pp. 40, 43, 51, 1983.
46. See Kidner, D., *Genesis*, Tyndale Press, London, p. 106, 1967. See also Leupold, H.C., *Exposition of Genesis*, Wartburg Press, 1942, repr. London, Evangelical Press, p. 360, 1972.
47. Bonfante, L., *Reading the Past: Etruscan*, British Museum Publications, London, U.K., pp. 19, 21, 1990.
48. Bonfante, ref. 47, pp. 47–48.
49. Huehnergard, ref. 21, p. xxi.
50. Edzard, D.O., *The Sumerian Language*, in *CANE IV*:2107, 1995.
51. Edzard, ref. 28, p. 4.
52. Edzard, ref. 28, p. 3, 174.
53. Thus Gragg, G.B., *Less-Understood Languages of Ancient Western Asia*, in *CANE IV*:2165, 1995. However, Jacob Dahl has proposed a Proto-Elamite script in distinction from the linear Elamite script, which he maintains is not a true writing system. However, while he is concerned with the script there may be implications for the language, but this is unconfirmed. See Dahl, J., *Early Writing in Iran: A Reappraisal*, *Iran* 47:32–31, 2009.
54. Wilhelm, ref. 38, p. 4.
55. Bonfante, ref. 47, p. 43.
56. See discussion by Gragg, ref. 53, pp. 2162–2163.
57. In Gardiner's sign list for Middle Egyptian he lists, in all, 734 signs as "the commonest hieroglyphs found in Middle Egyptian". See Gardiner, A., *Egyptian Grammar*, 3rd edn, Ashmolean Museum, Oxford, pp. 438, 443–542, 1957.
58. Gurney proposes that while Hurrian was the language of the populace of Mitanni, the empire was ruled by "a caste of Indo-Aryans", whose language had affinities with Sanskrit. Gurney, O.R., *The Hittites*, Penguin Books, London, UK, p. 107, 1990.
59. Edzard, ref. 28, p. 4; Wilhelm, ref. 38, p. 7.
60. Gurney, ref. 58, p. 101. See also Gragg, ref. 53, pp. 2174–2176.
61. See Huehnergard, ref. 21, pp. 599–603.
62. Care must be taken to distinguish the written attestation of a language from its actual existence as a *lingua franca*, which can be a gap of centuries. This is particularly so with Etruscan, and possibly Elamite (although on the latter see ref. 52).
63. As discussed in Aalders, G.Ch., *Genesis*, vol. I, Bible Student's Commentary Series, Engl. Tr. Zondervan Grand Rapids, MI, pp. 253–254, 1981.

Murray R. Adamthwaite graduated from Melbourne University in 1997 with a Ph.D. in Near Eastern History and Languages, and serves as sessional lecturer for the Centre for Classics and Archaeology. He also is Tutor in Old Testament with Tyndale College, Hunters Hill, NSW

The Red Sea Crossing: can secular science model miracles?

John K. Reed and Carl R. Froede Jr

Some secular scientists have a new strategy: instead of completely rejecting Scripture, they accept parts of it in exchange for the power to filter out God and His works, especially miracles. An example of this strategy is found in the attempt to explain the Red Sea crossing as a natural phenomenon. However, these explanations cannot explain the details of the biblical accounts or tests of self-consistency.

Instead of blatantly rejecting biblical history, some secularists are now explaining miracles as complex natural events. A recent example is the Red Sea crossing of Exodus 14. Oceanographers and atmospheric scientists have proposed natural explanations, supported by mathematical models.¹⁻³ This is a growing trend. For example, marine geologists concluded that Noah's Flood was merely the post-glacial, catastrophic infilling of the Black Sea.⁴ Their explanation was doomed by contradictions with both Genesis and field data.⁵⁻¹⁰ Close examination of these theories reveals key contradictions with the historical narrative and a troubling trend to a kinder face on the same old attacks.

Oceanographic explanation

Nof and Paldor^{2,3} explained the Red Sea crossing by mathematically computing an optimized water-receding distance and the approximate height of a return wave to kill the Egyptians. Note their sugar-coated positivist slant:

"We chose to deal with this unusual type of research that advances archaeology, biblical history, and religion as well as physical oceanography because we view the role of science as an aid not only in advancing its own cause but also in advancing other avenues of human endeavor."¹¹

In other words, Bible stories are acceptable as long as a secular science filters out God.

They suggested a crossing at the northern end of today's Gulf of Suez (figure 1). Fortuitous winds from the north-west were channelled between the mountains, creating sufficient velocity over a limited time and area to push water south in a 'setdown' or decrease in mean water level (table 1). Although the Hebrew term for the wind direction is most commonly translated 'east', Nof and Paldor assert a linguistic flexibility that allows it to mean 'north-west'—today's most common wind direction.

Crucial to their theory is tenuous timing. First, they proposed a tsunami to create a wall of water, generated by

a geologic event such as an earthquake, volcanic eruption, or plate motion. But there were two serious problems: 1) it ignores the strong wind in the text; and 2) water would move at the same speed in both directions, precluding sufficient time for Israel to cross. So they rejected a geologic cause but still concluded that the event could be explained by natural phenomena.¹²

Nof and Paldor³ broadened their analysis to include atmospheric data. Analysis of two different atmospheric probability models led them to conclude that the Gulf of Suez crossing was the result of a cyclical wind setdown with a ~1,000-year cycle. They also re-emphasized the submerged ridge and concluded:

"We have demonstrated that the likelihood of the storm necessary to 'part' the Red Sea (20 m s⁻¹ north-northwest wind blowing for 8–14 h over the Gulf of Suez) is once in a period of $O(1000 \text{ yr})$. We suggest that the Red Sea crossing has been termed a 'miracle' simply because the above likelihood period is greater than the human life span, so that even if it occurred at a given time prior to the legendary crossing, it was not remembered by later generations."¹¹

It may be convenient to see God's miraculous acts in history as merely fortuitous timing astounding credulous ancients, but the plain reading of the narrative is not so easily overcome. For example, what are the odds of the cycle occurring *exactly* when Moses raised his staff? What cycle might explain God's command to do so?

Atmospheric explanation

Drews and Han¹ noted the failure of Nof and Paldor to explain the most likely direction of the wind and the *two* walls of water. But they too think the answer is a wind setdown but affecting a lake in the north-eastern Nile Delta. Such an event was documented at Lake Menzaleh, to the west of the Suez Canal (figure 1), in 1882 by British Major-General Alexander B. Tulloch. An overnight, easterly wind pushed

the lake water approximately seven miles north-west, stranding boats that normally sailed in 1.5–1.8 m of water.

Based on this single event, Drews and Han¹ invoked a similar one for the Red Sea crossing, which they date at 1250 BC. We prefer an earlier date¹³ but leave that argument to others. Drews and Han¹ proposed an oxbow-shaped area across a possibly larger Lake Tanis, near the Pelusiac Branch of the Nile (figure 1). Using variable wind speeds of 100–118 km/h, they suggested a water level drop of 2 m in the lake and 3 m in the Pelusiac Branch of the Nile, exposing an area 5–6 km wide for approximately 3.9 hours. Although the area exposed might have been sufficient for ~2.5 million people and their animals to have crossed in a night, the time of 3.9 hours was not sufficient, especially given the extensive mud flats predicted by their computer model.

Discussion

Addressing the relationship between the Bible and forensic history will depend on one's worldview. This relationship is certainly more complex than presented by these secular authors. The Christian worldview constrains forensic history by the limited, but true, data in the narratives. On the other hand, naturalism attempts to control the meaning of the narrative via 'science'.^{14,15} Selective reading of the narrative, especially if God is excluded, is not helpful. Eliminating God's work in space and time from narratives that emphasize it is a philosophical choice, not a scientific one.

These studies also illustrate a tension between gradualism and actualism—the method that restricts interpretation of geologic strata in the past to the reservoir of observed

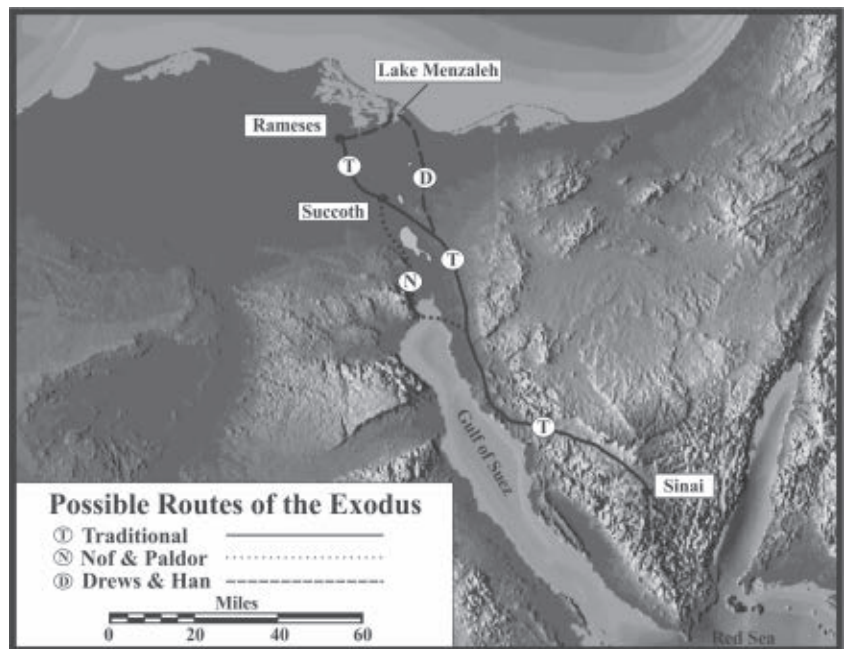


Figure 1. The traditional (T) route of the exodus from Unger⁴⁰ differs from those of Nof and Paldor (N) and Drews and Han (D). Climate change and variable sea level position over three millennia add uncertainty to the location of the Red Sea crossing.

geologic processes—in geologic thought. Gradualism has a difficult time with unique events, while observed rare events are not always a good template for the past by virtue of their rarity. Also, secular authors struggle to square the circle; to find a 'natural' answer to a supernatural event. Despite the occasional wind setdown of shallow lakes, this phenomenon is sufficiently distinct from the Red Sea opening to be a non-starter. Note how the authors use nebulous 'cycles' to place singular events safely back into the cage of gradualism.

The new strategy

Recent years have seen a new strategy by critics of Christianity. Instead of simply dismissing all Scripture, there appears to be a trend that accepts just enough of the Bible to satisfy a few Christians, while denaturing it of the divine

Table 1. Modelled setdown in northern Gulf of Suez from Nof and Paldor.² Highlighted row indicates their preferred set of conditions necessary to explain the crossing using a natural approach.

	Wind Speed		Sea-Level Drop		Receding Distance		Time to Maximum Withdrawl	Rate of Return		Time of Return
Hurricane Winds	35 m/s	78.3 mph	5.8 m	19.0 ft	3.0 km	1.9 mi	Not Calculated	5.0 m/s	11.2 mph	Minutes
Strong Winds	20 m/s	44.7 mph	2.5 m	8.2 ft	1.2 km	0.75 mi	"Several Hours"	5.0 m/s	11.2 mph	Minutes
Moderate Winds	7.0 m/s	15.7 mph	0.37 m	1.2 ft	0.2 km	0.12 ft	10 Hours	5.0 m/s	11.2 mph	Minutes

to satisfy fellow secularists. The Old Testament is no longer simple myth, a ‘dumbed-down’ account for ‘low-information’ ancients, or part of a religious conspiracy (e.g. Dan Brown’s novels). Instead, it is simply a rough history with the same errors found in any other account.

This new strategy may be a result of better apologetics and the better dissemination of information using the internet. Christian apologists have dissected the head-on attacks, and shown them filled with falsehood. For that reason, some secularists have abandoned the broadsword for the stiletto. Biblical accounts are granted a superficial historical reality but are filtered, by ‘scientific experts’, of the supernatural. The plagues of Egypt are attributed to the eruption of Santorini¹⁶ and the Flood to the post-Ice Age rise of the Black Sea level.⁴ Textual evidence for Hezekiah’s tunnel is ignored in favour of geological speculation.¹⁷ Jesus did not walk on water; he supported himself on the pile of stones in the Sea of Galilee.¹⁸ In a similar manner, historians praise Christianity for its (undeniable) role in fostering science¹⁹ and in providing a template for natural history in the 18th and 19th centuries,²⁰ although the Bible’s *accounts* of that history are dismissed as ‘outmoded interpretation’.²¹

But the end result is the same; the being, word, and work of God are denied. Attempts to grant secular legitimacy to biblical narratives thus amount to a form of control. Excluding the truth in exchange for partial ‘scientific’ acceptance makes secularists gatekeepers of truth. It is a subtle twist to the old fallacy of positivism. Note the iron fist inside the velvet glove in the first quote of this article above.¹¹

Implying that *any* part of the biblical narrative is false denies basic theology. It is impossible for God to lie (Hebrews 6:18) and *all* the Bible is *His* revelation (II Timothy 3:16). Christians who fall for the new secular strategy in the pursuit of intellectual respectability are borrowing trouble. When current theories are set aside for future ‘discoveries’, they will be left struggling to keep up.

Flaws in secular analyses of the Red Sea crossing

These ‘natural’ explanations of the Red Sea crossing fail for several reasons. They are inconsistent with the facts of the narrative. God is not hidden or obscure. He is the main character. If the Red Sea crossing was just a rare ‘natural’ event, Scripture is wrong, both in the immediate narrative and in its broader context. If one part is wrong, then any other part can be too.

Both the oceanographic and atmospheric theories invoke special events (natural miracles?) to satisfy their models. While attempting to accommodate *some* biblical history, they create an alternate reality. A cursory examination reveals their errors. There is confusion over wind direction. Geography is driven by convenience for models, not what the Bible says. Secular scholars cannot even agree on a location. Nof and Paldor^{2,3} look south; Drews and Han¹ to a northern lake.

Neither theory explains the walls of water or the *dry* land between. Both ignore the timing: extraordinary conditions begin *as needed*, are maintained *as needed*, and end precisely *as needed* to protect Israel. As a side note, the drowning of *all*

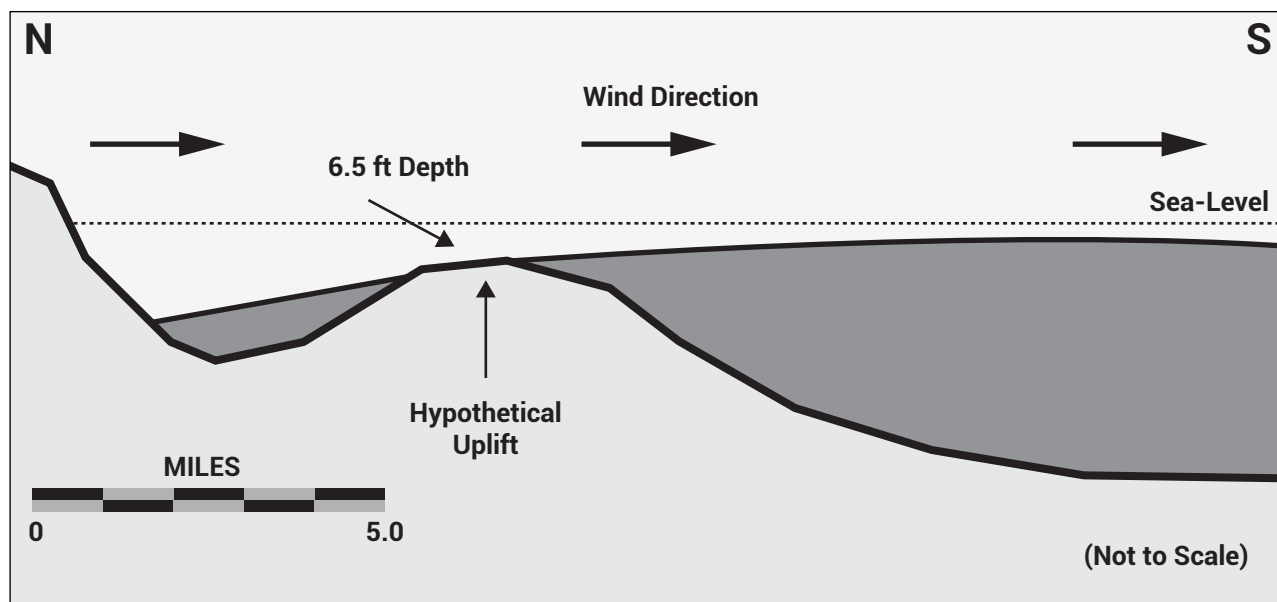


Figure 2. Nof and Paldor^{2,3} invoked a submerged land bridge. There is no present bathymetric evidence for it but it is necessary to their model, providing the ‘dry land’ passage after a wind setdown. (Modified from their figure 4.)

the Egyptians suggests too that the water depth was greater than the ~2 m proposed by Drews and Han.

Secularists miss the main point. Nature did not drive the events; God did. He controlled it. The Bible states that the wind blew all night from the east. Yet, the water also withdrew to the east.²² This contradicts modelling done by both groups.

The broader context also argues against ‘natural’ explanations. Israel has just escaped Egypt via a series of miraculous plagues that even pagan intellectuals thought had been caused by “the finger of God”.²³ Throughout the book, God speaks audibly. A cloud of fire leads Israel. Manna falls from heaven. Quail flock to the camp, as requested. Water comes from rocks on command. God speaks audibly to the whole congregation at Sinai. Oceanographic concerns, though interesting, are at best a sidebar.

Another problem is the dry land Israel crossed. A firm, dry path would have been necessary to carry the load of so many people and animals. But that creates serious problems for naturalists. It requires more than the removal of overlying seawater to create *dry* land; it also requires suppression of rising groundwater from the strata beneath the sea floor, especially in a muddy lake bed. Solid ground would have been even more necessary for the ‘*natural*’ explanations to succeed because, in both scenarios, Israel would have crossed in the face of near hurricane-force headwinds, an impediment strangely unmentioned in the narrative.

The ‘natural’ explanations rely on wind setdowns configured to preordained solutions in mathematical models. This kind of investigation is more directed mathematical speculation than science. Similar types of computer models have been questioned, discounted, or even rejected.^{24–26} Furthermore, both models show a low percentage of iterations that yield positive solutions.

If the Red Sea crossing is not sufficiently supernatural, it happened again at the Jordan River. The text itself links the two stories:

“For the Lord your God dried up the waters of Jordan from before you, until ye were passed over, as the Lord your God did to the Red sea, which he dried up from before us, until we were gone over: That all the people of the earth might know the hand of the Lord, that it is mighty: that ye might fear the Lord your God for ever.”²⁷

A secular bias is explicit in the articles; both selectively downplay or ignore God. Nof and Paldor state: “We shall not be concerned here with the question of whether a flight and crossing actually occurred in the past but rather with the issues of providing a possible scientific explanation for such a crossing.”²⁸ But if there was no crossing, then why waste time and money to derive some scientific ‘just so’ story? Drews and Han state: “The present study treats the Exodus 14 narrative as an interesting and ancient story of uncertain origin.”²⁹ This statement ignores internal textual statements, millennia-long tradition, and external evidence. Its origin is crystal clear. It is an exercise of the fallacy of ‘chronological snobbery’ that the story being ‘ancient’ and ‘of uncertain origin’ should convey a lack of confidence.

Footprint of the crossing

Biblical history, like all other history, is not a comprehensive recital of events. The Bible contains all we need for faith and practice, but that is often a brief overview and details must often be inferred. That is the case for Exodus 14 regarding any number of issues that excite human curiosity: the exact timing, the exact numbers of Israel and Egypt, the size of the sea’s opening, etc.

The difficulties in understanding these details can be seen in one of the more easily addressed issues—an inferred footprint of the people at the crossing. Limits can be placed using: (1) the duration of the crossing; (2) the

maximum distance travelled; and (3) the minimum width of the opening. Based on the census (table 2) taken shortly after the crossing (Numbers 1:46), we estimate a total population to have been at least 2,500,000. The average surface area per person can be extrapolated from studies of ancient armies. Marching Roman infantry soldiers required 1 m², although the area required for baggage and animals was much greater.³⁰ We believe that 3 m² per person is a *minimal* estimate for Israel, based on the presence of women, children, animals, and baggage.

That would yield a total area of 7.5 km². Length vs width can then be constrained to certain broad limits by the distance travelled in one night³¹ by those at the rear of the procession (figure 3). For example, a footprint 250 m wide would require a length of 30 km. One 500 m wide would require a length of 15 km. Thus, those in the

Table 2. Census of Israel taken two years following the Red Sea crossing

Tribe	Men > 20, Able to fight
Reuben	46,500
Simeon	59,300
Gad	45,650
Judah	74,600
Issachar	54,400
Zebulun	57,400
Ehram	40,500
Manasseh	32,200
Benjamin	35,400
Dan	62,700
Asher	41,500
Naphtali	53,400
Levites	Not numbered
TOTAL	603,550

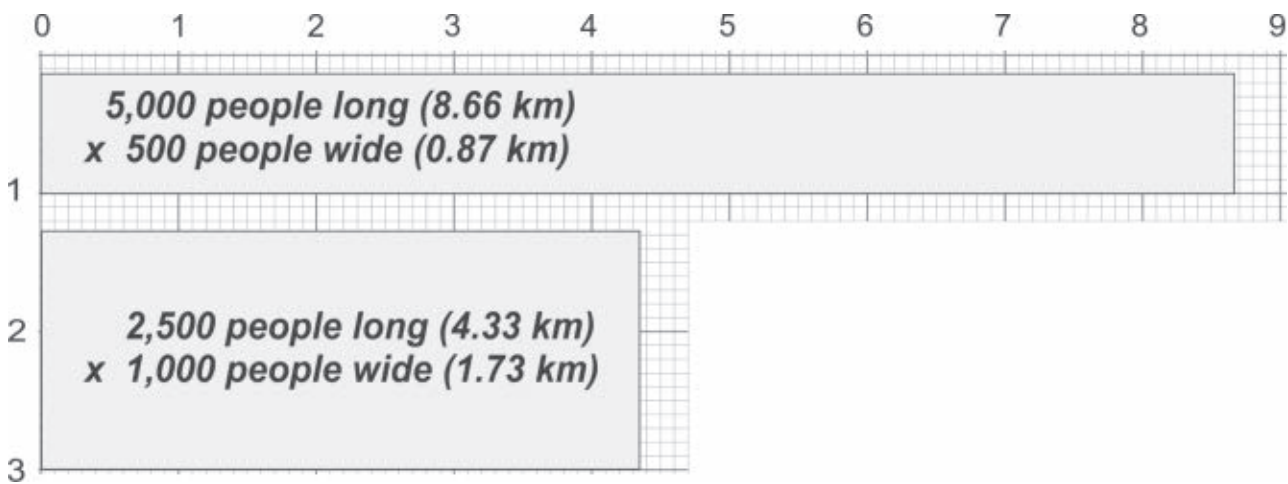


Figure 3. Potential footprints of the parted waters are constrained by the time for ~2.5 million people (and animals) to march in one night. A 1.73 x 4.33 km footprint (~1,000 x ~2,500 people) seems reasonable, although a narrower dimension 500 people wide and 5,000 people long would be possible. The relatively small area of even large numbers would allow for a variety of geographic locations, although a marching distance much greater than the ~17 km of the narrower option is probably near the upper limit for the time provided.

back would have to march 30 km in a single night. On the other hand, a width of 1.732 km would have allowed 1,000 people to march abreast, yielding a formation of 1,000 x 2,500 people, with a minimum length of 4.33 km. The resulting 8.66 km for those in the back of the formation would have been an easy night's march, even with animals and baggage. An average day's march for ancient armies was approximately 15 km. Thus, if Israel was 2.5 million people, the space required for them to cross was not large and could easily have been less than 1 km across. It could have been much wider; our estimates of space per person are minimal. Note too that the Jordan River was held back approximately 70 km upstream to allow a similar-sized population to cross its dry bed.³² That wider footprint allowed the Israelites to cross the river quickly, as suggested by the priests holding the ark the entire time and the time allowed for the gathering of rocks from the riverbed.³³ But the difficulties in exacting overly specific details are sufficient for caution.

What held the Red Sea in place?

Another miraculous aspect of the Red Sea crossing, commonly overlooked by naturalists, is the condition of the Red Sea water at the time of the crossing. The secular studies require a continuous, high-velocity wind setdown to prevent the parted water from closing during the crossing, but the Bible indicates that once formed, the walls of water were miraculously held in place without wind. They appeared to congeal; clearly an exercise of God's power outside of his usual limits of mediate providence that we call 'natural law'.³⁴ In fact, Scripture states that following the crossing, God brought the wind once again, but this time to drown

Pharaoh's army.³⁵ Natural events cannot comprehensively explain miracles, even if God makes use of natural means for a part of the event.

Location of the crossing

Secularists share one major uncertainty with generations of biblical scholars—the actual location. Places in Exodus (e.g. Pihahiroth, Migdol, and Baalzephon) are presently unknown. Creationists understand that this is complicated by (relatively) rapid climate and sea level changes since the mid-15th century BC and the potential effects on local geography. Of course, our modern ignorance of this detail does not disprove the account. Several potential crossing sites are possible.^{36–40}

However, Exodus 13:17–20 casts severe doubt on the location proposed by Drews and Han':

"And it came to pass, when Pharaoh had let the people go, that God led them not through the way of the land of the Philistines, although that was near; for God said, Lest peradventure the people repent when they see war, and they return to Egypt: But God led the people about, through the way of the wilderness of the Red sea: and the children of Israel went up harnessed out of the land of Egypt . . . And they took their journey from Succoth, and encamped in Etham, in the edge of the wilderness."

While the locations of Succoth and Etham are not currently known, Bible scholars generally regard this location as south of the eastern Nile Delta region (figure 1).

Conclusion

Secularists have a new strategy. Instead of flatly rejecting the Bible, they use ‘faint praise’ by offering ‘natural’ explanations of miraculous events. An example is the escape of Israel from Egypt by the Red Sea crossing. In place of a miracle, the crossing was the result of a wind setdown or a subsea ridge, or both. However, their ‘explanation’ ignores the facts of the narrative; most importantly, they ignore the presence of God and the stated purposes of the miracle—showing the world His power, identifying Israel as His protected people, and confirming the status of Moses as His prophet. A similar attempt to explain the Flood as a relatively minor sea level rise at the Black Sea shares the same shortcomings.

Christians should be aware of a new secular strategy. Christian academics, especially, should beware of receiving the gnat of historical verisimilitude while swallowing the camel of the secular worldview and its authority to determine which parts of the Bible are true and which are not. It is simply another attempt to deny God’s power and presence in this world, and yet ... He is not far from each one of us.⁴¹

References

1. Drews, C. and Han, W., Dynamics of wind setdown at Suez and the Eastern Nile Delta, *PLoS ONE* 5(8):e12481, doi:10.1371/journal.pone.0012481, 2010.
2. Nof, D. and Paldor, N., Are there oceanographic explanations for the Israelites’ crossing of the Red Sea? *Bulletin of the American Meteorological Society* 73(3): 305–314, 1992.
3. Nof, D. and Paldor, N., Statistics of wind over the Red Sea with application to the Exodus question, *J. Applied Meteorology* 33:1017–1025, 1994.
4. Ryan, W.B.F. and Pitman, W.C. III., *Noah’s Flood: The New Scientific Discoveries about the Event that Changed History*, Simon and Schuster, New York, 1998.
5. Byers, G.A., The Flood of Noah and the Black Sea, *Creation Matters* 6(1):1, 6, 2001.
6. Froede, C.R. Jr, Is the Black Sea flood the Flood of Genesis? *Creation Matters* 6(1): 1–4, 2001.
7. Froede, C.R. Jr, Uniformitarian scientists pull the plug on the Black Sea flood, *Creation Matters* 7(4):3–4, 2002.
8. Froede, C.R. Jr, Shallower and less catastrophic: the Ryan/Pitman “Noah’s Flood Hypothesis”, *Creation Matters* 14(2):1,4, 2009.
9. Walker, T., The Black Sea flood: definitely not the Flood of Noah, *J. Creation* 14(1): 40–44, 2000.
10. Walker, T., The Black Sea flood may evaporate completely, *J. Creation* 16(3): 3–5, 2002.
11. Nof and Paldor, ref. 3, p. 1024.
12. Cf. Anonymous, Oceanographic explanations: The Israelites’ crossing of the Red Sea, *FSU Oceanography Newsletter*, pp. 1–2, February 1992.
13. Jones, F.N., *Chronology of the Old Testament*, Master Books, Green Forest, AR, 2005.
14. Reed, J.K. and Froede, C.R. Jr, A biblical Christian framework for Earth history research, part III—constraining geologic models, *CRSQ* 33:285–292, 1997.
15. Reed, J.K., Modern geohistory: an assault on Christianity, not an innovative compromise, *CRSQ* 46(3):201–216, 2010.
16. Cameron, J., *The Exodus Decoded*, History Channel, 2006.
17. Maeir, A.M. and Chadwick, J.R., Regarding recent suggestions redating the Siloam tunnel, Bible History Daily, www.biblicalarchaeology.org/daily/biblical-sites-places/jerusalem/regarding-recent-suggestions-redating-the-siloam-tunnel, 19 August 2013.
18. Kloosterman, K., The mystery mound where Jesus walked on water? *Israel 21c*, israel21c.org/social-action-2/the-mystery-mound-where-jesus-walked-on-water, September 2013.
19. Stark, R., *For the Glory of God*, Princeton University Press, Princeton, NJ, 2003.
20. Rudwick, M.J.S., *Bursting the Limits of Time*, University of Chicago Press, Chicago, IL, 2005.
21. Cf., Reed, J.K., Soft secularism is no solution: a critique of Rudwick’s Postscript in *Worlds Before Adam*, *J. Creation* 26(2):25–29, 2012.
22. Exodus 14:21.
23. Exodus 8:19, NIV.
24. Bredehoeft, J., The conceptualization model problem—surprise, *Hydrogeology J.* 13(1):37–46, 2005.
25. Molnia, B.F., Modeling geology—the ideal world vs the real world, *GSA Today* 6(5):8–14, 1996.
26. Oreskes, N.K., Shrader-Frechette, K. and Belitz, K., Verification, validation, and confirmation of numerical models in the earth sciences, *Science* 263:641–646, 1994.
27. Joshua 4:23–24, KJV.
28. Nof and Paldor, ref. 2, p. 305.
29. Drews and Han, ref. 1, p. 1.
30. Brueggeman, G., The basics, www.garyb.0catch.com/march2_basics/march_basics.html, 14 August 2013.
31. Exodus 14:20, 24.
32. Joshua 3:16–17.
33. Cf. Joshua 3:13–4:11.
34. Exodus 15:8.
35. Exodus 15:10.
36. Hays, J.D. and Duvall, J.S. (Eds.), Exodus: deliverance and the presence of God; in: *The Baker Illustrated Bible Handbook*, Baker Publishing Group, Grand Rapids, MI, pp. 57–77, 2011.
37. Jenkins, S., *Bible Mapbook*, Lion Publishing, Belleville, MI, 1985.
38. Laney, J.C., *Baker’s Concise Bible Atlas: A Geographical Survey of Bible History*, Baker Publishing Group, Grand Rapids, MI, 1988.
39. Orr, J., Nuelsen, J.L., Mullins, E.Y., Evans, M.O. and Kyle, M.G. (Eds.), Red Sea; in: *The International Standard Bible Encyclopaedia*, vol. IV Pelet—Zuzim, Eerdmans Publishing, Grand Rapids, MI, pp. 2538–2541, 1956.
40. Unger, M.F., *Archaeology and the Old Testament*, Zondervan Publishing, Grand Rapids, MI, 1954.
41. Acts 17:27.

John K. Reed earned B.S., M.S., and Ph.D. degrees in geology. He worked for several decades as a professional geologist in industry and academia. In 1998, John became the geology editor of the *Creation Research Society Quarterly*, and was subsequently elected to the CRS Board of Directors. He has written and edited numerous books and articles about Creation and natural history.

Carl R. Froede Jr. has been active in creation geology since 1988. He has a Bachelor of Science in geology from the University of South Alabama and his geological career has encompassed a wide range of activities. These include oil and gas exploration, public health related soil analysis, groundwater aquifer containment, underground waste management and groundwater modelling. At present he is employed as a professional geologist with the US Government Environmental Protection Agency dealing with geological aspects of waste disposal.

Instructions to Authors

JOURNAL OF CREATION is dedicated to upholding the authority of the 66 books of the Bible, especially in the area of origins. All our editors adhere to the Creation Ministries International (CMI) Statement of Faith and most papers will be designed to support this. Rarely, other papers may be accepted for publication on merit so that certain issues can be clarified. The views expressed in the papers are those of the authors and not necessarily those of CMI.

Because the scope of this journal is broad, we welcome articles on any topic that is relevant to biblical creation. This includes the sciences such as geology, chemistry, biology, astronomy, etc., and also archaeology, theology, hermeneutics, biblical history, geography, linguistics, ethics and society, philosophy, law, etc. Potential authors should familiarise themselves with the journal and its position and style before submitting articles. Authors should also indicate if their manuscript has been submitted elsewhere, address previous articles on the topic, and ensure the work of others is properly acknowledged.

Word length: Shorter articles are more likely to be read so preference will be given to publishing them. All articles, including letters, may be edited for brevity and clarity. Perspectives: 1,000–2,000 words; Book reviews: 1,500–3,000 words, but please enquire first. You may be asked to scan the cover of the book; Letters to the editor: 1,000 words. We will publish critical letters on articles already published, but a reply will usually follow the criticism; Papers, Overviews, Countering the Critics, Viewpoints and Essays: <5,000 words.

Articles must be written clearly and concisely and should be focused on only one topic/subject. The most readable articles are those with an average sentence length of about 17 words, with one idea per sentence. Do not use too many big or extra words such as “in spite of the fact that” when “although” would do. Please use first person sparingly and do not use “this present writer”, which is verbose false modesty and ambiguous. Care with spelling is crucial, and British spelling generally applies. Personal invective or similar comments against others are not acceptable.

Specialist technical terms and abbreviations should be defined the first time they are used. If many technical terms are used, these should be included in a glossary. SI units should be used in scientific papers. Words in non-Latin alphabets (e.g. Hebrew, Greek and Russian) must use Unicode characters and be accompanied by a transliteration, also in Unicode characters (Unicode should avoid errors when the file is transferred to a publishing program or HTML).

Abstract: All articles except Perspectives, Letters and Book Reviews should be preceded by an Abstract, which should not exceed 200 words and must be without abbreviations and reference citations. The Abstract should summarise the key points of the paper and be comprehensible to readers before they have read the paper.

References should be indicated in the main text by superscript numbers in sequence and then listed in numerical order at the end of the text (End Notes). Full details of all references are required, including all authors and their initials, the full title of the paper or book, the full title of the journal or its accepted abbreviation, the volume number, the page number(s), the editor(s) of the book or proceedings (if applicable), the publishers and place of publication (in the case of a book), and the year of publication. If a citation is repeated, then the same superscript number should be used (a cross reference).

Quotes must be verbatim, with omissions clearly shown by ellipsis (...). Even erroneous grammar and spelling in the original must be reproduced, and indicated by [sic]. Any additions or explanations within a quote need to be placed in square brackets []. Primary sources are preferred, but if a secondary source must be used, the reference format must be [primary source], as cited in [secondary source]. For internet URLs the date last downloaded should be included.

Tables should be embedded in a Microsoft Word document, with brief, self-explanatory titles, and captions if an explanation is essential to understanding the table. Tables should be numbered according to their sequence in the text and all should be referred to in the text, e.g. (see table 1).

Graphics should be supplied electronically on CD or by email to journal@creation.info as 300dpi *.TIF, *.EPS, *.PSD, *.AI, *.JPG, *.PDF or *.BMP files, not embedded into a document file. They can be sent in colour or greyscale, but will appear only in greyscale in the journal. Graphics should have a minimum size of 80 mm x 80 mm when printed (preferably 1024 x 768 pixels). Photographs are acceptable provided they have good contrast and intensity, and are submitted as sharp, glossy copies or as 35 mm slides. Computer print-outs are not acceptable.

Figures should be numbered according to their sequence in the text. References should be made in the text to each figure. In planning images and figures, the page format and column widths of the journal should be kept in mind and should allow for the possibility of reduction. Each illustration should have a self-explanatory caption. The captions should be collected together at the end of the article document file. If graphics are not provided with a manuscript, authors may be asked to submit suggestions and possible sources of non-restricted material.

Copyright ownership for each and every graphic must be specified and any relevant permissions and or credit requirements given in writing. If you are not the copyright owner, please supply written permission (preferably with an original signature) from the copyright owner. If you are the copyright owner, your submission of a graphic will be taken to grant us permission to use the image in the journal and also any other publications or on our website, unless you specify otherwise.

Biography: Papers, Overviews, Countering the Critics, Forums, Viewpoints, Research Notes and Essays should include a biography of no more than 100 words for each author. It should include the authors' qualifications and experience, and involvement in creationist work.

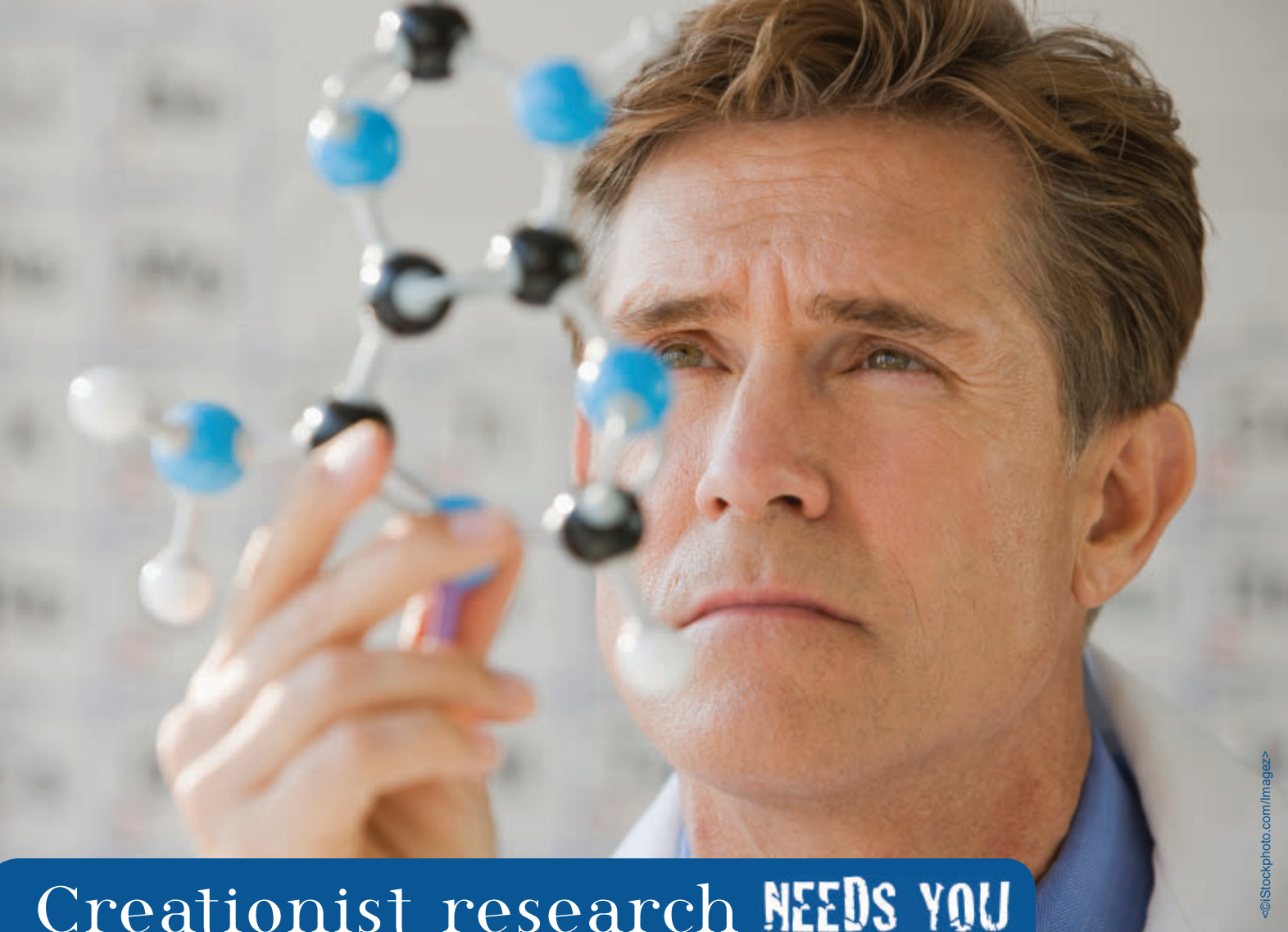
Please also:

- send documents in Rich Text (*.rtf) or Word (*.doc) format, not Publisher (*.pub) format. Excel (*.xls) is also acceptable for complicated tables.
- type left-justified without hyphenation except for compound words
- input text continuously; only insert hard returns at the end of sections, lists, etc.
- use single spaces after each sentence within a paragraph
- use Times New Roman 10.5 font and use the word processing formatting features to indicate bold, italics, Greek, Hebrew, maths, superscript and subscript characters
- submit complex mathematical formulas or equations using MathType according to the guidelines in our “Equations layout guide”, which can be obtained by contacting us
- insert captions for graphics at the end of your manuscript
- type references in the correct order and style of the journal using the word processing “Endnotes” and “Cross-references” features to link references to the text correctly.

Photographs and/or CDs may be sent to journal@creation.info

The Editor,
Journal of Creation
Creation Ministries International
P.O. Box 4545
Eight Mile Plains QLD 4113
AUSTRALIA

NOTE: Papers prepared according to these instructions are more likely to be considered.



<©iStockphoto.com/Imagez>

Creationist research NEEDS YOU

Christians need to keep on providing scientific answers within a biblical framework, and refining our case (including exposing whatever flaws there may be in old arguments). We also need to be ready to respond to challenges by critics.

Faith-funded creationist ministries like *Creation Ministries International Ltd* (CMI) can only do so much, not having access to taxpayer dollars.

Creationist membership societies with hundreds of scientist members are encouraging by their very existence. But they are usually just as hampered by funding constraints, and would dearly love more of their members to get involved in actively helping the creationist model.

We have many qualified scientists and other educated professionals on our mailing lists, and we would like to encourage more of you to each give just a little bit of spare time to creation research issues.

GETTING INFORMED

Start by getting as informed as possible through the existing literature. CMI can provide up-to-date catalogues.

JOINING THE NETWORK

Consider researching a particular area with a view to producing a paper. *Journal of Creation* is a great place to air it. CMI is more than willing to provide refereeing through our contacts. If you are concerned that publishing in a creationist journal might affect your employment, for example, a pseudonym may be acceptable. If you are keen to write, see our instructions to authors opposite.

Remember that the creation/evolution issue is often not so much about *facts* as about their *interpretation*. Often the research results produced by secular institutions operating within an evolutionary framework can be just as useful in providing answers for creationists—it just needs someone to go

to the trouble of working it through. We can provide some guidance about how you can draw your research into a suitable paper.

NO CONTRIBUTION TOO SMALL

Even producing a brief Perspective item on a specialist area, if it will teach and inform *Journal of Creation* readers, and enable them to share with others, is a worthwhile contribution.

AND FINALLY ...

You might want to consider a donation earmarked specifically for creationist research. If so, you could direct it to any of the CMI offices listed at the front of this journal. Such donations may be tax deductible in certain countries.

THE FAMILY COMPANION TO
JOURNAL OF CREATION



CREATION magazine

IN A WORLD FLOODED WITH ANTI-CHRISTIAN MEDIA, it's nice to come home to a publication that upholds the truth of God's Word ... all the way from Genesis. Packed full of fascinating articles and beautiful full-colour photography. Creation appeals to both young and old.

Enjoy subjects ranging from the wonders of nature to creation/evolution, archaeology and practical Christian living.

Special children's section sure to interest your younger family members.

Join subscribers across the globe and let *Creation* magazine be your family's life-changing experience too!

// 56
PAGES OF FULL
COLOUR
[NO PAID ADVERTISING]

Subscribe via **CREATION.com**, mail or phone
(see inside front cover for contact details).

ISSN 1036-2916



9 771036 291007 >